



# ENVIRONMENTAL ASSESSMENT BOARD

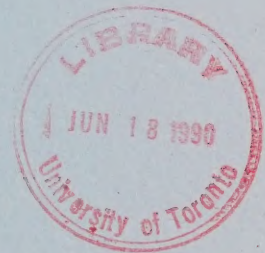
VOLUME: 211

DATE: Monday, June 4, 1990

BEFORE:

A. KOVEN, Chairman

E. MARTEL, Member



FOR HEARING UPDATES CALL (TOLL-FREE): 1-800-387-8810

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HEARING ON THE PROPOSAL BY THE MINISTRY OF NATURAL  
RESOURCES FOR A CLASS ENVIRONMENTAL ASSESSMENT FOR  
TIMBER MANAGEMENT ON CROWN LANDS IN ONTARIO

IN THE MATTER of the Environmental  
Assessment Act, R.S.O. 1980, c.140;

- and -

IN THE MATTER of the Class Environmental  
Assessment for Timber Management on Crown  
Lands in Ontario;

- and -

IN THE MATTER OF a Notice by the  
Honourable Jim Bradley, Minister of the  
Environment, requiring the Environmental  
Assessment Board to hold a hearing with  
respect to a Class Environmental  
Assessment (No. NR-AA-30) of an  
undertaking by the Ministry of Natural  
Resources for the activity of timber  
management on Crown Lands in Ontario.

-----

Hearing held at the offices of the Ontario  
Highway Transport Commission, Britannica  
Building, 151 Bloor Street West, 10th Floor,  
Toronto, Ontario, on Monday, June  
4th, 1990, commencing at 8:30 a.m.

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VOLUME 211

BEFORE:

MRS. ANNE KOVEN  
MR. ELIE MARTEL

Chairman  
Member



A P P E A R A N C E S

MR. V. FREIDIN, Q.C.)	
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MS. K. MURPHY )	RESOURCES
MS. Y. HERSCHER )	
MR. B. CAMPBELL )	
MS. J. SEABORN )	MINISTRY OF ENVIRONMENT
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MR. R. TUER, Q.C.)	ONTARIO FOREST INDUSTRIES
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MR. B. McKERCHER)	OUTFITTERS ASSOCIATION



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MR. C. BRUNETTA	NORTHWESTERN ONTARIO TOURISM ASSOCIATION



(iv)

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<u>Witness:</u>	<u>Page No.</u>
<u>WILSON EEDY,</u> <u>KARL SCHIEFER,</u> <u>GORDON R. CRAIG,</u> Sworn	37811
Direct Examination by Mr. Cassidy	37811
Cross-Examination by Mr. Castrilli	37921



I N D E X   O F   E X H I B I T S

<u>Exhibit No.</u>	<u>Description</u>	<u>Page No.</u>
1222	OFIA/OLMA Panel 9A witness statement.	37809
1223	Nishnawbe-Aski Nation Interrogatory Question No. 3 re OFIA/OLMA Panel 9A and answer thereto.	37822
1224	MOE Interrogatory Question No. 3(b) and (c) re OFIA/OLMA Panel 9A and answer thereto.	37827
1225	Hand-drawn diagram of AOC designations depicting first and second order streams.	37846
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1232	Forests for Tomorrow Interrogatory Question Nos. 1-16 re OFIA/OLMA Panel 9A.	37920



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<u>Exhibit No.</u>	<u>Description</u>	<u>Page No.</u>
1233	Document entitled: Draft Environmental Impact Statement, Vegetation Management in the Ozark/Ouachita Mountains, Volume II authored by the USDA Forest Service, Southern Region, dated June, 1989.	37959



1 ---Upon commencing at 8:30 a.m.

2 MADAM CHAIR: Good morning, please be  
3 seated.

4 Mr. Cassidy?

5 MR. CASSIDY: Good morning. Good  
6 morning, Mr. Martel.

7 We're ready to commence the next panel,  
8 Madam Chair, Panel 9A consisting of three witnesses.  
9 Perhaps what I can do first is file a copy of the  
10 witness statement for this panel with the Board and  
11 with the reporter and ask that it be marked as the next  
12 exhibit.

13 MADAM CHAIR: That's Exhibit 1222.

14 ---EXHIBIT NO. 1222: OFIA/OLMA Panel 9A witness  
15 statement.

16 MR. CASSIDY: Madam Chair, the three  
17 witnesses are seated before you. I will introduce them  
18 and then give a brief statement as to what they will be  
19 testifying about and then ask that they be qualified.

20 Closest to you is Dr. Wilson Eedy, in the  
21 middle is Dr. Karl Schiefer, and at the far end is Mr.  
22 Gordon Craig.

23 They are all consultants with the company  
24 called Beak Consultants Limited. Particulars of that  
25 company and details of what that company does can be

1 found at Tab B being Appendix B of Exhibit 1222. The  
2 curriculum vitae of each one of these witnesses can be  
3 found at Appendix A or Tab A of Exhibit 1222.

4 This panel, Madam Chair, just very  
5 briefly - I don't intend to get into any lengthy  
6 opening statement - will discuss the effects of  
7 harvesting, tending and protection activities on  
8 wildlife and aquatic resources and their respective  
9 habitats in the area of the undertaking.

10 And at this point I propose to have the  
11 witnesses qualified and I will list that for you. Dr.  
12 Schiefer, I propose to have qualified as an expert  
13 witness in aquatic ecology with particular expertise in  
14 fisheries biology and impact assessment; Mr. Craig will  
15 be qualified as an expert witness in toxicology with  
16 expertise in aquatic toxicology, toxic and hazard  
17 assessment, and toxic and hazard assessment techniques;  
18 and Dr. Eedy will be qualified as an expert witness in  
19 wildlife biology and impact assessment.

20 And I ask that they be so qualified, and  
21 I believe all wish to be sworn.

22 Is that correct, gentlemen?

23 PANEL COLLECTIVELY: (nodding  
24 affirmatively)

25 MADAM CHAIR: Would you please approach

1 us.

2 WILSON EEDY,  
3 KARL SCHIEFER,  
4 GORDON R. CRAIG, Sworn

5 MR. CASSIDY: Thank you, Madam Chair. I  
6 can advise that the evidence will be presented this  
7 morning in the following order: Dr. Eedy will  
8 commence, followed by Dr. Schiefer, and we will  
9 conclude with Mr. Craig.

10 DIRECT EXAMINATION BY MR. CASSIDY:

11 Q. If I could commence then with Dr.  
12 Eedy's evidence, and for the Board's benefit that can  
13 be found in Section 1 of the witness statement, Exhibit  
14 1222, commencing on page 1 running through to page 11  
15 entitled: Harvesting Activities and Wildlife  
16 Resources.

17 And if I could ask you, Dr. Eedy, to  
18 briefly at the outset summarize your evidence as  
19 contained in these pages for the benefit of the Board  
20 and then we will discuss individual aspects of it.

21 DR. EEDY: A. Yes, Madam Chair and Mr.  
22 Martel, my evidence will discuss the effects of  
23 harvesting activities on wildlife species and habitat  
24 in the area the undertaking with particular emphasis on  
25 the boreal forest.

In particular, I will discuss comparisons

1       between -- which can be drawn between natural  
2       disturbances such as forest fires and harvesting  
3       practices as they are conducted in Ontario in relation  
4       to their wildlife effects.

5               I will also discuss the MNR featured  
6       species approach and some of the new management tools  
7       that are available to help in applying this. The  
8       issues will be discussed in terms of regional and local  
9       wildlife population protection needs.

10              The thrust of my evidence in these issues  
11       is that similar effects occur on wildlife after both  
12       natural and harvest-induced disturbances. My overall  
13       conclusion is that Ontario's wildlife species have  
14       adapted to a disturbance-generated habitat and, in the  
15       absence of natural disturbances, harvesting can be a  
16       necessary tool which can be used to provide the  
17       diversity and early successional stages of habitat  
18       which the majority of Ontario's wildlife species  
19       require.

20              Q. I just ask you to slow down just a  
21       bit, Dr. Eedy. All right. Now, if we can move on to  
22       the next portion of your evidence being Section 1.2,  
23       Madam Chair and Mr. Martel, dealing with the comparison  
24       of natural and timber harvest disturbances.

25              And would you please summarize the

1 evidence as contained in that portion for the benefit  
2 of the Board?

3 DR. EEDY: A. Yes. Madam Chair, as Dr.  
4 Methven testified in Panel 6, the boreal forest in  
5 Ontario is a disturbance-dependent forest. It requires  
6 periodic disturbances for the normal vegetation  
7 communities to regenerate. Dr. Methven also testified  
8 that present fire management in Ontario has reduced the  
9 natural disturbance from this source to about five to  
10 10 per cent of its historical levels. It is my view  
11 that the majority of the wildlife species in this area  
12 are also disturbance-dependent and require such  
13 disturbance for their survival.

14 Both natural fire and harvest disturbance  
15 return the forest to an earlier succession stage; older  
16 trees are removed, giving younger trees, as well as  
17 understorey vegetation the chance to grow. This  
18 provides a richer, more nutritious, more accessible and  
19 more diverse food supply for wildlife, as well it  
20 provides more abundant and diverse habitat for many of  
21 the species which are living on the ground. As the  
22 forest matures less diverse habitat and browse is  
23 available. Trees grow beyond the reach of many of the  
24 species of wildlife and the ground vegetation is shaded  
25 out. In general, the evidence indicates that as the

1 forest matures to about 50 per cent canopy cover, the  
2 ground level vegetation is at about 75 per cent of the  
3 value that it is in an open forest condition, and this  
4 relationship continues as the forest matures and, in  
5 fact, there are a number of references which indicate  
6 that the peak forest value is when the forest is under  
7 20 to 30 years in its maturity after disturbance.

8 The major difference between fire and  
9 harvest disturbances is that fires are less  
10 controllable than harvest activities; thus, as pointed  
11 out by Dr. Euler in Panel 10, harvesting provides an  
12 ideal management tool with the potential to enhance the  
13 diversity and value of wildlife habitat.

14 Q. That's MNR's Panel 10?

15 A. Yes, that's correct.

16 Q. Thank you.

17 A. Forest fires do not allow this same  
18 management potential.

19 My evidence also refers to the size of  
20 disturbances. From a wildlife perspective I agree with  
21 the evidence given by Dr. Euler in the MNR Panel 10  
22 that the size of a disturbance is less important than  
23 the species present and their habitat requirements.

24 Other factors which I feel can be more  
25 important to wildlife than the absolute size of harvest

1 area or other disturbance include the shape of the  
2 disturbance or cut, this generally affects the amount  
3 of edge effect or edge diverse habitat available for  
4 wildlife; the amount of residual vegetation which is  
5 left within a cut area including buffers around aquatic  
6 habitat and buffers which would be left for areas of  
7 concern or other habitat features; and unmerchantable  
8 timber which can be left standing.

9 I have provided some discussion in my  
10 written evidence regarding the appropriate application  
11 of wildlife habitat or species protection guidelines.  
12 In referring to the scoping question which was posed by  
13 the Board regarding mitigation of harvest effects and  
14 local versus regional concerns for wildlife, I believe  
15 the same answer applies to the wildlife protection or  
16 habitat protection guidelines. It is only pertinent to  
17 strictly apply these guidelines or mitigating measures  
18 in areas where important habitat or species  
19 concentrations occur. To apply them uniformly  
20 throughout the area of the undertaking would, in my  
21 view, be overly conservative.

22 The example given in our written evidence  
23 is the 80 to 130-hectare cutting guideline which is in  
24 the habitat guidelines for moose. It was developed in  
25 reference to research on critical winter habitat needs

1 for this species. Winter habitat is the most critical  
2 time of year, it's the time of year when energy  
3 supplies are least available and when energy is most  
4 required; and, thus, it is the most rigorous time of  
5 year that the animals must survive.

6 In areas where there is no critical  
7 winter habitat, such restrictions are not necessarily  
8 warranted. It is my opinion that local expertise and  
9 judgment should be used on a case-by-case and  
10 site-specific basis to determine whether such  
11 guidelines are appropriate and, if so, how they should  
12 be applied.

13 Q. All right. Dr. Eedy, if I could ask  
14 you to move to the next portion of your evidence that  
15 we wish to discuss this morning. Madam Chair, that can  
16 be found at page 4 of the witness statement and this  
17 deals with the mitigation of harvest impacts on  
18 wildlife. For your reference that is Section 1.2.2  
19 found on page 4 of Exhibit 1222.

20 And could you please summarize the  
21 evidence for the benefit of the Board there, Dr. Eedy?

22 DR. EEDY: A. Yes.

23 Q. And please take your time.

24 A. Madam Chair and Mr. Martel, I  
25 believe -- I've summarized the points that I want to

1 make on page 6 of this witness statement. I believe  
2 that where the potential exists for adverse impacts  
3 from harvesting activities on the wildlife populations  
4 or habitats in the area of the undertaking, it is my  
5 opinion that proven management techniques are available  
6 to mitigate against such effects.

7 I would like to give just a few examples  
8 of what I feel are the more important mitigation  
9 techniques which should be used in areas where the  
10 importance of wildlife habitat warrants these and where  
11 practical from a technical point of view. And again I  
12 emphasize that my belief is that such determinations  
13 should be made in the field on a site-specific basis by  
14 qualified personnel.

15 The key points I believe, the first point  
16 is that by varying patterns and shapes of cuts one can  
17 maximize the edge effect, and I believe the edge effect  
18 or the diverse area of habitat inbetween the more  
19 mature forest and the cut area is a very important  
20 habitat value for the majority of wildlife.

21 The second point, and I believe this is a  
22 very essential point, is that I believe that in areas  
23 where there has been cutting that it is very important  
24 to control the access to these areas by especially  
25 hunters and other members of the public because I

1 believe the potential for impact on wildlife from such  
2 activities is greater than it is from the harvesting  
3 per se.

4 I believe that it is important to,  
5 wherever possible, leave residual timber in areas of  
6 buffer zones, wetland areas, areas of difficult terrain  
7 where harvesting is not really a feasible or economic  
8 activity.

9 I also believe from a wildlife  
10 perspective that it's important, wherever possible, to  
11 leave stands of merchantable timber within the cut  
12 area.

13 I also, and as a final point, believe  
14 that by planning over the large timber area to manage  
15 cuts in a manner that provides a balance of even-aged  
16 stands that this can benefit the wildlife population in  
17 general.

18 Q. If we could move on then to page 7 of  
19 Exhibit 1222, Section 1.3, Madam Chair, Mr. Martel, I  
20 would like to ask Dr. Eedy to summarize his evidence in  
21 respect of the featured species approach, which I  
22 understand he wishes to provide to you.

23 Would you please do that, Dr. Eedy.

24 A. Yes. Madam Chair, and Mr. Martel, as  
25 I said at the onset, the majority of wildlife species

1 in Ontario, especially in the area of the undertaking,  
2 have evolved adaptations which depend on similar  
3 disturbance-generated habitat; thus, the featured  
4 species approach as proposed by MNR, by managing  
5 habitat to benefit one such species or several such  
6 species, benefits the majority of other species within  
7 similar habitat requirements or with similar habitat  
8 requirements.

9 Now, within the Exhibit 923 the featured  
10 species approach is said to benefit about 80 per cent  
11 of the wildlife species or the approach using moose as  
12 a featured species.

13 MR. CASSIDY: Just for your reference,  
14 Madam Chair, Exhibit 923 is the article by Baker and  
15 Euler filed in MNR's panel 16 entitled: Wildlife  
16 Habitat Inventory and Population Monitoring Objectives  
17 for 1989-1990, and that can be found in Volume 156 of  
18 the transcript where it was introduced.

19 MADAM CHAIR: And that was which exhibit  
20 number, Mr. Cassidy?

21 MR. CASSIDY: That is Exhibit 923.

22 MADAM CHAIR: Thank you.

23 MR. CASSIDY: Volume 156.

24 DR. EEDY: Yes. Madam Chair, as I  
25 indicated, by managing to protect one species or to

1 provide habitat for one species such as moose one is  
2 providing habitat for the species which have similar  
3 requirements, which this article in evidence as an  
4 exhibit has indicated would cover about 80 per cent of  
5 the species in the area of the undertaking.

6 In addition, where species have unique  
7 requirements or are limited in range or population,  
8 mechanisms are available to afford them special  
9 protection, in fact in both Exhibit 923 and MNR Exhibit  
10 433, which I believe is the Featured Species Management  
11 in Ontario paper by Baker and Euler --

12 MR. CASSIDY: That's filed in MNR's Panel  
13 10 at Volume 77.

14 MADAM CHAIR: Excuse me, Dr. Eedy, what  
15 was the exhibit number on that?

16 DR. EEDY: 433 and also in 923 which I  
17 just referred to previously.

18 MADAM CHAIR: And one other thing, did  
19 you say there was protection for 70 per cent of other  
20 species?

21 DR. EEDY: Well, the testimony -- that  
22 paper, 433, actually indicates that 37 out of 309  
23 species are not specifically protected and that  
24 actually says, if you calculate it, that more than 80  
25 per cent would be.

1                   In the evidence the 70 per cent number is  
2                   also referred to and I'm not quite sure why that was in  
3                   the MNR evidence, why they switched from one to the  
4                   other. I presume that it is an estimate.

5                   MR. CASSIDY: Q. Your figure is based on  
6                   a numerical calculation of 37 out of 309?

7                   DR. EEDY: A. Yes, it is, within Exhibit  
8                   433. Within Exhibit 433 and Exhibit 923 they discuss  
9                   mechanisms for using as featured species any threatened  
10                  or endangered species, as well as locally important  
11                  species of wildlife on a site-specific basis.

12                  So I believe that those latter provisions  
13                  would cover a majority, if not all, of the remaining  
14                  species. In my evidence I have also discussed some of  
15                  the new computer-generated tools which would aid in the  
16                  application of such wildlife management approaches.

17                  Q. I understand that, Dr. Eedy, in  
18                  respect of this portion of your evidence you wish to  
19                  refer to an answer given to an interrogatory by the  
20                  Nishnawbe-Aski Nation in respect of this panel.

21                  MR. CASSIDY: Madam Chair, I have copies  
22                  of it now. It's NAN Interrogatory No. 3 and I will  
23                  pass out copies and ask that it be marked as the next  
24                  exhibit for Dr. Eedy to refer to.

25                  MADAM CHAIR: That would be Exhibit 1223.

1                   ---EXHIBIT NO. 1223: Nishnawbe-Aski Nation  
2                                   Interrogatory Question No. 3 re  
3                                   OFIA/OLMA Panel 9A and answer  
                                 thereto.

4                   MR. CASSIDY: Madam Chair, just as a  
5 point of clarification, there are separate  
6 interrogatories for Panel 9B which will be following  
7 this panel. So you will potentially - and I have no  
8 idea - but you might potentially see a Question No. 3  
9 for Panel 9B as well. I just wanted you to be aware  
10 that there are two separate sets.

11                  Q. All right. If you could please speak  
12 to this interrogatory, Dr. Eedy?

13                  DR. EEDY: A. Yes. Madam Chair and Mr.  
14 Martel, I think this is fairly important because the  
15 computer modeling approach has been discussed to some  
16 extent and I believe, in some cases, there is a little  
17 bit of confusion over just what it is and how it  
18 applies.

19                  The NAN Interrogatory No. 3 asked for a  
20 comparison of GIS and HSA approaches to the MNR  
21 featured species approach. Our response was that these  
22 approaches are complementary and not exclusive; and,  
23 thus, they are not truly comparable. GIS and HSA are  
24 tools that can be used to help to predict and manage  
25 the effects of wildlife habitat changes on featured

1 species through the majority of other wildlife species.

2 I would like to amplify on the response  
3 that was given to this interrogatory a bit. First, I  
4 would like to just very quickly go through some  
5 background on the abbreviations that are used because  
6 they seem to be used rather extensively.

7 HSA or habitat supply analysis is a term  
8 that is used in New Brunswick and other jurisdictions  
9 for a mathematical model which predicts the ability of  
10 different habitat types to produce and support wildlife  
11 species. HSI or habitat suitability index and HEP or  
12 habitat evaluation procedures --

13 Q. Could you just stop there just so we  
14 can all write this down.

15 A. HSI is habitat suitability index, and  
16 HEP are habitat evaluation procedures. These are terms  
17 which have been coined for similar procedures developed  
18 by the U.S. Fish and Wildlife Service and I believe  
19 that their development somewhat pre-dates the use or  
20 development in Canada and is also extended to a great  
21 deal larger number of species.

22 Although these techniques have been  
23 around for some time they have recently become more  
24 prominently accepted by wildlife professionals, and I  
25 believe that part of the reason for this is that their

1 use is being facilitated greatly by another emerging  
2 tool and this is the computerized GIS or geographic  
3 information system, which I believe the Board has  
4 already had some information on.

5 MADAM CHAIR: Yes we have, Dr. Eedy.

6 DR. EEDY: I think, in my view, the  
7 important thing to understand about the GIS and the HSA  
8 or similar habitat predictive models is that these  
9 represent spacial data management and temporal  
10 predictive tools respectively.

11 MR. CASSIDY: Q. So...

12 DR. EEDY: A. Well, what I mean by this  
13 is these are not magical things that, you know, come up  
14 with answers on their own, they are basically tools  
15 which can be used with information input to manage  
16 those information and to provide an objective manner in  
17 assessing the importance of that information.

18 As such, they are not really directly  
19 comparable to the various wildlife management  
20 approaches available such as the featured species  
21 approach.

22 Q. So if I can just stop you there, Dr.  
23 Eedy. GIS is the spacial data tool?

24 A. Yes.

25 Q. And HSA is the temporal data tool?

1 A. Yeah, it's the model.

2 Q. Model.

3 A. The predictive model.

4 Q. All right.

5 A. I guess HSA or GIS can be compared a  
6 lot to something like a D-base III program which --  
7 except that it mentions data as sort of mapped forms of  
8 data as well as tables of data; whereas the D-base kind  
9 of program only manages tables. But it's basically  
10 just manages the data that are put into it.

11 Q. All right.

12 A. As I indicated, the comparison with  
13 management techniques such as the featured species  
14 approach, they really aren't comparable, they're things  
15 which when combined, the combination of a GIS and/or  
16 HSA, with a featured species approach could greatly  
17 improve the efficiency with which future wildlife  
18 biologists could predict and manage habitat effects on  
19 wildlife species and populations.

20 And I believe that Exhibit 923, which I  
21 referred to earlier, in the last paragraph on page 8  
22 also acknowledges the importance of HSA and within that  
23 whole exhibit there are references to the MNR's  
24 proposal to expand the use of that kind of approach.

25 Q. All right.

1 MR. CASSIDY: Madam Chair, Mr. Martel, if  
2 we could then move to page 9 of the witness statement  
3 which is Section 1.4.

4 Q. And, Dr. Eedy, I understand you wish  
5 to summarize your evidence briefly in respect of  
6 regional and local and provincial wildlife population  
7 protection concepts that can be found in this portion  
8 of your evidence through to page 10?

9 DR. EEDY: A. Yes. I believe that this  
10 is a fairly important point that has been made but  
11 bears being repeated.

12 Madam Chair, Mr. Martel, I feel that the  
13 issue of the importance of protecting regional or  
14 provincial populations versus local wildlife  
15 populations is critical to the understanding of the  
16 issues we are discussing. It is the protection of a  
17 viable species population as it exists on a regional or  
18 provincial or even wider basis rather than the local  
19 population that is most ecologically important.

20 I would like to amplify this by providing  
21 response to Ministry of Environment Interrogatory No. 3  
22 parts (b) and (c).

23 MR. CASSIDY: I have a copy of that for  
24 the benefit of the Board and the parties, and ask that  
25 it be made the next exhibit, which I believe is 1224.

1 (handed)

2 MADAM CHAIR: Yes, Mr. Cassidy.

3 ---EXHIBIT NO. 1224: MOE Interrogatory Question  
4 No.3(b) and (c) re OFIA/OLMA  
Panel No. 9A and answer thereto.

5 DR. EEDY: Parts (b) and (c) of this  
6 interrogatory, Exhibit 1224 --

7 MR. CASSIDY: Just one second.

8 DR. EEDY: Okay.

9 MADAM CHAIR: Is this the answer to one  
10 question?

11 MR. CASSIDY: Yes, it's the answer to  
12 Question 3. Dr. Eedy will be referring specifically to  
13 parts (b) and (c) which can be found on page 2 of the  
14 answer, Madam Chair. The complete interrogatory answer  
15 is filed but he will be referring to those two parts.

16 DR. EEDY: Yes. The two questions that I  
17 will provide the answers to, the first question (b) is:

18 "What species can permanently be affected  
19 by disturbance due to timber harvesting?"

20 And the second or part (c) sort of  
21 continues on from that by saying:

22 "What happens to species in the event  
23 that there are no nearby areas of their  
24 preferred habitat types."

25 And the answers to those two parts are on

1 the next page of the exhibit.

2 Madam Chair and Mr. Martel, there is no  
3 evidence to suggest that any species is permanently  
4 affected by harvesting. Harvesting provides a  
5 relatively short-term disturbance to the forest. As I  
6 said earlier, the boreal forest is dependent on such  
7 periodic disturbances. It cyclically goes through  
8 growth, maturity and disturbance stages to start over  
9 again in early successional stage.

10 Wildlife live in the forest when it is in  
11 the succession stage to which each particular species  
12 has adapted and, as I indicated earlier, the succession  
13 stages in the sort of 10 to 30 years after disturbance  
14 are the stages to which the majority of wildlife  
15 species have adapted best. In general, there is a  
16 potential for some individuals of a species to be  
17 affected in the immediate harvest area at the time that  
18 succession is interrupted; however, it is most unlikely  
19 that following harvest no nearby areas of preferred  
20 habitat type will exist for any particular species.  
21 More particularly, unless the population of the species  
22 is small or its habitat is specific and limited in its  
23 distribution, the situation is unlikely to occur.

24 And I might add to that that within the  
25 approach that is used to protect wildlife habitat in

1 timber harvesting areas there are mechanisms for  
2 protection of threatened or endangered or locally  
3 important species populations within the featured  
4 species approach, Exhibit 433, and there are also  
5 mechanisms such as areas of concern and buffer zones  
6 around aquatic or wetland habitats to protect for these  
7 types of species as well.

8 MR. CASSIDY: Q. In your view, Dr. Eedy,  
9 are those appropriate and adequate mechanisms?

10 DR. EEDY: A. In my view they are, yes.

11 Q. I would then ask you, Dr. Eedy, to  
12 move to the concluding part of your evidence in Section  
13 1 dealing with the conclusions. If you could please  
14 summarize those for the benefit of the Board?

15 DR. EEDY: A. Yes. Madam Chair and Mr.  
16 Martel, I believe these are summarized on page 11 as  
17 four numbered point. Based on my review of the class  
18 environmental assessment, the evidence and exhibits  
19 before the Board to date, based on my professional  
20 experience as a wildlife biologist, I have reached the  
21 following conclusions relevant to the proposed  
22 undertaking and its potential effects on wildlife and  
23 wildlife habitat in Ontario.

24 I believe that timber harvesting as  
25 proposed will not adversely impact on the wildlife

1 population of Ontario.

2 I believe that the majority of wildlife  
3 species will benefit from timber harvesting activities  
4 over the long term; in other words, I believe more  
5 benefit than disbenefit.

6 I believe that most wildlife species in  
7 Ontario, and especially in the area of the undertaking,  
8 have adapted to and in fact depend on periodic  
9 disturbances similar to those resulting from current  
10 harvest practices to provide the early succession  
11 vegetation and diversity of habitat which they prefer  
12 to rely on.

13 Any displacement of wildlife which does  
14 result from harvesting activities or the resulting  
15 disturbance or alteration of the habitat is, in my  
16 view, generally of short-term duration and quickly  
17 recovers.

18 MR. CASSIDY: That concludes Dr. Eedy's  
19 evidence-in-chief, Madam Chair. I would then like to  
20 move on to Dr. Schiefer.

21 Dr. Schiefer will be referring to some  
22 drawings on the easel and it may be necessary, when we  
23 get to that point, to have the easel, depending on  
24 whether or not the Board can see them and the other  
25 parties, but we just wanted to alert you to that and

1 we'll be coming to it in short order.

2 MADAM CHAIR: Excuse me, Mr. Cassidy,  
3 just one question.

4 Or Dr. Eedy, rather. You talk about  
5 harvesting, you're including other timber management  
6 activities as well, but looking at harvesting because  
7 it's the most disruptive of the activities?

8 DR. EEDY: Yes, and when I refer to  
9 harvesting too, in general I'm referring to  
10 clearcutting as it's practiced in the boreal forest  
11 because I feel this is the most disturbance-related  
12 activity.

13 MADAM CHAIR: All right.

14 DR. EEDY: But I do and I did refer  
15 specifically to other things such as access roads,  
16 which I believe in the long run have the greatest  
17 potential for impacting on wildlife species and are  
18 really the aspect which I believe requires most  
19 significant management.

20 MR. CASSIDY: Q. Your focus, however, in  
21 this evidence is on harvesting; is that correct?

22 DR. EEDY: A. Yes, that's correct.

23 MR. MARTEL: Can I...? If you're  
24 harvesting in an area, and I believe you said you would  
25 have to limit access, are you talking about restricting

1 hunting per se as opposed to trying to --

2 DR. EEDY: Sorry, go ahead.

3 MR. MARTEL: For example, or are you  
4 talking about destroying the road once it's there so  
5 that people can't get to where the harvesting has  
6 occurred.

7 DR. EEDY: Well, there are a number of  
8 perspectives on that, and certainly I'm not an expert  
9 in the planning aspects, but I do believe there are  
10 some values to some of these roads in terms of being  
11 able to regenerate the forest and also fire protection  
12 and things like this.

13 However I do -- from an access  
14 perspective I think the most potentially damaging  
15 wildlife effect is the hunter access. Again, I believe  
16 that this is a site-specific issue and it really has to  
17 be determined by specifically the MNR biologist and  
18 experts in the district or region,

19 In some areas the population may support  
20 additional hunting pressure and in fact, as I believe  
21 is given in the MNR evidence, they believe that by  
22 controlling the total number of hunters when you access  
23 a new area it displaces the hunting from an area that  
24 may have been overhunted before and allows the  
25 population there to recover.

1                   So I think these are issues that really  
2                   have to be answered on a site-specific basis. I think  
3                   the potential to manage that effect is important.

4                   MR. CASSIDY: If I may move on to Dr.  
5                   Schiefer, Madam Chair, Mr. Martel. Dr. Schiefer will  
6                   be giving evidence in respect of Section 2 of the  
7                   witness statement which, for your notes, commences at  
8                   page 12 and runs through to page 19 of Exhibit 1222.

9                   Q. And as with Dr. Eedy, Dr. Schiefer, I  
10                  would ask that you first briefly summarize your  
11                  evidence of what you wish to offer to the Board this  
12                  morning?

13                  DR. SCHIEFER: A. Yes. Members of the  
14                  Board, this evidence examines the impact of possible  
15                  effects of timber harvesting and tending on aquatic  
16                  resources. In particular, the impact of effects such  
17                  as increased water yield, nutrient input, increased  
18                  water temperature, erosion and sedimentation have been  
19                  considered.

20                  Depending on the magnitude, the exact  
21                  location and duration of the effect, as well as the  
22                  previous condition of the aquatic environment, these  
23                  effects can be positive, negative or neutral with  
24                  respect to various aquatic resources. My statement of  
25                  evidence discusses these in greater detail with

1 supporting references.

2 On page 13 I've just listed the topics  
3 under which the evidence is organized. They include  
4 the criteria for identifying and designating areas of  
5 concern, the concept of ecosystem protection as it  
6 relates to using primarily fish species as featured  
7 species, harvest operations and the constraints placed  
8 on these for protection of aquatic resources, buffer  
9 zone widths and the criteria used to determine these,  
10 and the need for management flexibility in applying the  
11 guidelines and codes of practice to optimize their  
12 effects and minimize any negative effects on other  
13 resource values.

14 My evidence focuses on key issues in  
15 aquatic resource protection relating to harvesting and  
16 tending procedures and whether these procedures are  
17 sufficiently protective of aquatic resources.

18 It is my conclusion that the provisions  
19 of the Timber Management Guidelines for the Protection  
20 of Fish Habitat which is Exhibit 303, the Code of  
21 Practice for Timber Management Operations in Riparian  
22 Areas which is Exhibit 434, and the Access Guidelines  
23 which are Exhibit 683 are sufficient for the long-term  
24 protection and management of aquatic resources in the  
25 area of the undertaking.

1                   However, management flexibility in the  
2 application of these guidelines is necessary to  
3 optimize the protection of aquatic resources without  
4 having an undue negative effect on other associated  
5 resource values such as timber management.

6                   MR. CASSIDY: If we could then move to  
7 page 13, Madam Chair, the Section 2.2 dealing with AOC  
8 identification.

9                   Q. And I understand, Dr. Schiefer, you  
10 wish to commence your evidence in this respect by  
11 dealing with a matter raised in the scoping session?

12                  DR. SCHIEFER: Yes. One of the questions  
13 raised by the Board was the question of first order  
14 streams which is a concept that we use in our statement  
15 of evidence, and the request was for a definition of a  
16 first order stream.

17                  To respond to that I would like to use  
18 one of the drawings provided by Dr. Allin in his  
19 testimony.

20                  MR. CASSIDY: I believe this is Exhibit  
21 504, Madam Chair, which you have in your hands now.

22                  Dr. Schiefer has a copy of Exhibit 504  
23 which he's going to put up on the easel, and I trust  
24 that can be seen by all the parties, and the Board has  
25 the copy of the original in front of it.

1 Can you see that, Mr. Martel?

2 DR. SCHIEFER: Okay. In his testimony  
3 Dr. Allin used this drawing to describe and to define  
4 the application of the guidelines in terms of  
5 designation of headwater areas as areas of concern, and  
6 he used the drawing to determine which tributary  
7 systems to lakes larger than or smaller than the  
8 10-hectare criteria would qualify for AOC, area of  
9 concern designation.

10 In his drawing he shows tributary systems  
11 which hydrologists and fishery biologists normally  
12 refer to by stream order. It's a classification system  
13 that provides a more systematic way of looking at  
14 tributary and river systems.

15 Very simply the very smallest headwater  
16 tributary stream is a first order stream. Where two  
17 first order streams converge, from that point  
18 downstream you have a second order stream. In his  
19 drawing where these two second order streams join, from  
20 that point downstream you have a third order stream.

21 MR. CASSIDY: Q. You're referring to the  
22 right-hand side of Exhibit 504, the lines that are  
23 eventually ending up in the circle marked lake greater  
24 than 10 hectares?

25 DR. SCHIEFER: A. Yes, I am. So really

1       it's nothing more than a classification system for  
2       streams, with the larger the stream order number  
3       normally the larger and further down in the watershed  
4       it occurs.

5                   Q. Dr. Schiefer, in your view, is it  
6       necessary for the guidelines to be applied to all first  
7       order streams?

8                   A. No, in my opinion it is not. The  
9       fish habitat guidelines provide a prescription for the  
10      designation of headwater streams which would be covered  
11      as areas of concern. There are circumstances where all  
12      first order streams, that is, all of the extreme  
13      headwater tributaries would fall under this designation  
14      resulting in the possible exclusion of timber  
15      harvesting activities from relatively large land areas.

16                   This concern is raised in the guidelines  
17      themselves and was mentioned by Dr. Allin in his  
18      testimony. Rather than have this type of automatic  
19      designation in situations where they may not be  
20      appropriate or necessary for the protection of aquatic  
21      resource values, it is my opinion that all first order  
22      streams need not be designated automatically as AOCs.

23                   Such designation should also consider  
24      factors such as soil erodability, stream gradient,  
25      aquatic resource features, the presence of critical

1 habitats and the expected degree of disturbance. This  
2 should be assessed on a site-by-site --

3 Q. I'm sorry, Dr. Schiefer.

4 MR. CASSIDY: Just for the Board's  
5 benefit, those are listed at the top of page 14.

6 Q. And I'm sorry to interrupt you, Dr.  
7 Schiefer.

8 DR. SCHIEFER: A. The existence and  
9 significance of these factors should be assessed on  
10 site-by-site basis by qualified specialists. I would  
11 like to use another drawing to illustrate the nature of  
12 this particular concern.

13 MR. CASSIDY: Now, Dr. Schiefer, drew  
14 this this morning on an easel which we may have to move  
15 closer to the Board, once you have a look at it. Are  
16 you able to see that, Mr. Martel?

17 All right. It may be appropriate now to  
18 move it over to the corner so all the parties have the  
19 benefit of it, as well Dr. Schiefer.

20 MR. CASTRILLI: If it's less  
21 inconvenient, I can just simply move to the far wall.  
22 ---Discussion off the record.

23 DR. SCHIEFER: Can everyone see that?

24 MR. CASSIDY: Q. Okay, fire away.

25 DR. SCHIEFER: A. Okay. This drawing is

1 an extrapolation of the same concept of demonstration  
2 that Dr. Allin used, showing in this case a lake larger  
3 than 10 hectares which would qualify for designation as  
4 an AOC for protection of aquatic resource values.

5 In this case we have a system of  
6 tributaries. In this case four tributary systems and  
7 an outlet system which, because of various provisions  
8 in the guidelines, strictly applied without any  
9 site-specific considerations.

10 The dotted green line would approximate  
11 the area of concern that would be designated, the  
12 10-hectare lake, tributary systems to it, up to extreme  
13 headwater lakes; these systems by and large lacking any  
14 bogs, small lakes and settling basins between the  
15 extreme first order stream and the 10-hectare lake.

16 It is my contention that application of  
17 the guidelines as more or less a desk exercise using  
18 topographic maps to designate streams, perhaps a  
19 calculation of slope and the drawing of these  
20 boundaries without site-specific application of these  
21 other criteria which I just listed perhaps provides for  
22 excessive restrictions on timber harvesting.

23 In this case it may well be just because  
24 of the configuration of these tributary systems that  
25 designation of an AOC more typical of the dotted red

1 line which in this case would include second order  
2 streams for these three tributaries, perhaps the entire  
3 watershed of this tributary, because in this example  
4 this may be determined to be the watershed used for  
5 spawning and rearing of trout populations in the lake.

6 Q. You're referring to the tributary at  
7 the bottom left-hand corner of this diagram?

8 A. Yes, I am. In other words, a  
9 site-specific reconnaissance and data collection may  
10 well determine that this tributary and perhaps the  
11 lower reaches of these tributaries are the important  
12 habitats for protection, that first order streams in  
13 this particular area may be -- may have a very low  
14 sensitivity to timber harvesting effect because of  
15 stream gradient, soil erodability, water retention  
16 capability, any number of factors.

17 The difference between the two I have  
18 shown as a hashed green area and the concept simply is  
19 that the dotted red line may provide the same benefit  
20 to aquatic resource protection as the dotted green  
21 line, the difference being a relatively large area that  
22 would be excluded from timber harvesting activity.

23 Q. So the green line, the dotted green  
24 line represents the strict application of the  
25 guideline?

1 A. Yes, it does.

2 Q. And the dotted red line represents  
3 what we might call a site-specific application of the  
4 guideline?

5 A. It could also fall within the  
6 prescriptions of the guidelines but taking advantage of  
7 the recommended flexibility and site-specific  
8 application of various criteria.

9 The concern clearly is that without the  
10 site-specific application an overly conservative,  
11 virtually a desk exercise of drawing lines based on  
12 definitions of lake size and just the simple existence  
13 of tributary systems might lead to this type of  
14 application of the guideline.

15 MR. MARTEL: We heard that and it's the  
16 evidence that the size of an area that a forester is  
17 responsible I think is in the neighbourhood of in  
18 Ontario, I might be wrong, over a half million acres I  
19 believe; whereas in Europe they might have 10,000  
20 hectares.

21 Is it your opinion that a forester with  
22 that amount of space to look after, if I can use that  
23 term, can in fact go out and walk all of these areas to  
24 ensure that what you're indicating to us can work, that  
25 they can't do it from a desk you're saying and they

1 must go out and view it first-hand, but if you have  
2 half a million hectares or acres, I forget which it is,  
3 under your supervision, how much staff is it going to  
4 require to do this sort of on-the-ground evaluation to  
5 make the type of determination you're suggesting; more  
6 or less staff than would be required than we presently  
7 have?

8 DR. SCHIEFER: Well, clearly there's a  
9 different scale of problem between forest management in  
10 Europe and Canada. I think some of the concepts that  
11 Dr. Eedy talked to a moment ago, really the development  
12 of remote sensing technologies, the development of GIS  
13 systems, will go a long way to providing assistance in  
14 doing these kinds of designations.

15 We are working on a couple of projects  
16 currently which are digitizing specifically this kind  
17 of information over relatively large areas. I don't  
18 think we are there yet, I don't think we have the staff  
19 to do it to this level of detail, but I also don't  
20 think that we can use the argument that because our  
21 timber lands are as vast as they are that we needn't  
22 really look at these kinds of decisions more related to  
23 site conditions than simply providing perhaps  
24 excessively conservative guidelines.

25 MR. CASSIDY: Q. Is it also the case in

1 your knowledge, Dr. Schiefer, that more than just the  
2 forester does this?

3 DR. SCHIEFER: A. Yes. Actually the  
4 application of the specific criteria I'm suggesting  
5 here would really be more the responsibility of those  
6 charged with managing the fishery resource.

7 The fishery biologist would determine  
8 where the critical habitats are, which tributary  
9 systems and which portions of those tributary systems  
10 represent important habitats, and to what degree a  
11 riparian zone or stream-side vegetation is critical to  
12 protecting those habitat values.

13 Q. As a result then is it appropriate to  
14 simply look at the number of foresters in a unit to  
15 determine the number of people in fact -- I'm sorry, is  
16 it appropriate to look at simply the number of  
17 foresters in a unit to determine the number of people  
18 that might be needed to do this?

19 A. No, I believe not.

20 MR. MARTEL: But if there are no  
21 biologists in an area - and I believe we heard that  
22 there were areas where we did not have biologists in  
23 the province in some of the -- what do you do then?

24 I mean, if you don't have foresters and  
25 you don't have a biologist and it's the biologist's

1 work, who is going to do the type of work that you're  
2 suggesting to ensure that everything is protected?

3 MR. CASSIDY: Q. Does it require  
4 qualified personnel, Dr. Schiefer?

5 DR. SCHIEFER: A. Well, to some degree  
6 it does. It requires personnel, not necessarily  
7 professional biologists, but certainly someone with  
8 enough field experience to be able to make a judgment  
9 as to what represents habitat values or require  
10 protection.

11 I think the risk is that at one extreme  
12 if there is little or no site application done then you  
13 wind up around each watershed perhaps with the  
14 designations of the dotted green line which clearly  
15 represent a measurable negative impact on timber  
16 harvesting values. At the other extreme - and I would  
17 not suggest at all that the areas of concern be reduced  
18 to absolute minimum values - this however -- I mean,  
19 this concept of site-specific application which really  
20 endorses what the guidelines themselves call for and  
21 what a number of witnesses have also talked to,  
22 represents the optimal application of the guidelines  
23 and really I think it's that simple concept that I  
24 would like to leave.

25 Q. And what do the green hash marks in

1           this drawing represent?

2                       A.   The green hash marks are a simple  
3           illustration of the difference between an automatic  
4           designation of AOCs based on the strictest  
5           interpretation of the guideline provisions without  
6           site-specific application, and the dotted red line  
7           which is a more site-specific application of the  
8           guideline; the hash green area represents the area that  
9           could be harvested with site-specific application  
10          compared --

11                      Q.   I'm sorry.   And with that  
12          application, in your view, would aquatic values be  
13          adequately protected?

14                      A.   In this example, yes.   I'm not  
15          suggesting for a moment that aquatic resource values be  
16          compromised by reducing the guidelines or their  
17          provisions, simply that all first order streams need  
18          not necessarily be included in areas of concern.

19                      And in the written evidence we have  
20          provided some examples, as they are also provided in  
21          some of the other evidence provided, that in fact  
22          cutting activities of a certain prescription within  
23          these areas provide neutral, in some cases even  
24          positive benefits.

25                      MR. CASSIDY:   Perhaps we can have this

1 diagram entered as the next exhibit, Madam Chair.

2 MADAM CHAIR: That would be Exhibit 1225.

3 MR. CASSIDY: And if it could be  
4 entitled: Hand drawn diagram of AOC Designations.

5 ---EXHIBIT NO. 1225: Hand-drawn diagram of AOC  
6 designations depicting first and  
second order streams.

7 MR. CASSIDY: Mr. Freidin has asked that  
8 we include in that title of this document, depicting  
9 first order streams. Is that accurate, Dr. Schiefer?

10 DR. SCHIEFER: Yes. It shows on it first  
11 order streams and second order streams. It shows those  
12 two classes of streams.

13 MR. CASSIDY: Perhaps then the title  
14 could be depicting first and second order streams.

15 MR. FREIDIN: Thank you.

16 MR. CASSIDY: All right. Madam Chair,  
17 Mr. Martel, if we could then move - subject to any  
18 questions you have at this point - to the next section  
19 of Dr. Schiefer's evidence, that being Section 2.3  
20 entitled: Ecosystem Protection Concept. That can be  
21 found for your reference on page 14 of the witness  
22 statement.

23 Q. And if you could please summarize  
24 your evidence in that section, Dr. Schiefer?

25 DR. SCHIEFER: A. Yes. Members of the

1 Board, the fish habitat guidelines are clearly intended  
2 to protect aquatic ecosystems which support fish  
3 populations. This objective is described in the  
4 introduction to the guidelines. In our opinion, one of  
5 the most effective means of accomplishing this is  
6 through the use of a featured species approach using a  
7 fish species for this purpose.

8 The typical featured fish species are  
9 generally more sensitive to environmental change than  
10 are lower trophic levels in the aquatic ecosystem and,  
11 as ecosystem integrators, tend to reflect any  
12 significant change in ecosystem structure or function.

13 This approach is now widely accepted as  
14 an effective and practical means for protecting and  
15 managing aquatic resources in Ontario and elsewhere.  
16 It should ensure regional persistence of existing  
17 aquatic communities as well as most of their component  
18 species.

19 I would also like to respond to an  
20 interrogatory which the Ministry of Environment raised  
21 on this issue, Interrogatory No. 6 I believe.

22 MR. CASSIDY: And I have copies of that,  
23 Madam Chair. (handed)

24 MADAM CHAIR: This is Exhibit 1226.

25 ---EXHIBIT NO. 1226: MOE interrogatory No. 6 re

OFIA/OLMA Panel 9A.

MR. CASSIDY: Q. Yes, go ahead, Dr.  
Schiefer.

DR. SCHIEFER: A. Yes. The question  
asked:

"What data or studies relevant to Ontario  
were relied on to formulate this  
opinion?"

The answer basically identifies that  
there is a massive database that relates to individual  
species' sensitivities and responses and response  
thresholds to a long list of environmental factors.

For instance, if one considers an  
increase in maximum water temperature as the  
environmental factor and brook trout as the featured  
species, brook trout are likely to display a negative  
response to this factor before other species or aquatic  
community functions at lower trophic levels.

Similarly, depending on the featured  
species selected, the response to changing  
environmental factors such as increase in turbidity,  
nutrient loading, changed stream morphology, increase  
in fishing pressure, or whatever, is more likely  
exhibited in a measurable and ecologically significant  
form by the featured species than by other components

1 of the aquatic ecosystem.

2 The featured species, if properly  
3 selected, functions as a useful indicator, integrator  
4 and management focus for protecting and monitoring the  
5 ongoing health of aquatic ecosystems for one cannot and  
6 need not measure the individual responses of hundreds  
7 or thousands of aquatic species at all trophic levels  
8 in the ecosystem.

9 Q. Would you explain just briefly the  
10 concept of lower trophic levels for the benefit of the  
11 Board?

12 A. Trophic levels, I believe the term  
13 has been used before in these hearings, refers to  
14 different groups or communities of species at different  
15 levels in food chains, in this case aquatic food  
16 chains.

17 At the lowest level normally you find  
18 primary producers. In aquatic systems these would be  
19 phytoplankton and aquatic plants. In a simplified  
20 ecosystem you would have primary producers, primary  
21 consumers would be those plants or those animals that  
22 feed directly on primary producers on plants or  
23 phytoplankton, would include species like zoo plankton.

24 Secondary consumers would be smaller fish  
25 species, forage fish species. Tertiary consumers would

1 be predator species normally at the top of the food  
2 chain. These are the species that normally are  
3 selected as featured species, primarily because they  
4 tend to be the game fish species and the commercial  
5 fish species most heavily utilized by man.

6 I think the concept here is that an  
7 organism at the top of the aquatic food chain or any  
8 food chain is an integrator of all effects that happen  
9 within the food chain below it.

10 For instance, if a disturbance of any  
11 kind has an effect on primary production lower in the  
12 trophic level, the example I would use is temperature,  
13 and the source of that change or that disturbance could  
14 be totally natural - it could be a warmer summer this  
15 year than the past year - the fact that water  
16 temperatures are a little higher may well favour one  
17 group of primary producers, one group of phytoplankton  
18 to the disadvantage of another group because these  
19 species at that trophic level exist and compete with  
20 each other in space and time. However, ecosystem  
21 function at that level, the level of primary  
22 production, can be totally maintained although one  
23 group of species may be more abundant in a particular  
24 year or group of years than another.

25 The effect at higher levels in the

1 trophic food chain may be totally unnoticeable simply  
2 because ecosystem function has been maintained and the  
3 concept here is not one that the featured species  
4 necessarily protects the individual status of hundreds  
5 of species at a lower trophic level, simply that  
6 ecosystem function is maintained and the result, in  
7 terms of survival and abundance of the featured  
8 species, is what you measure. It tends to integrate  
9 all of those cumulative effects at lower trophic  
10 levels.

11 Q. Dr. Schiefer, is the concept of  
12 maintaining ecosystem function an appropriate goal, in  
13 your opinion?

14 A. I believe it is. The only possible  
15 exception to that would be where a rare and endangered  
16 species is involved. At that point clearly there is  
17 legislation that would focus on protecting that  
18 individual species more so than its particular role in  
19 the ecosystem.

20 Q. When you use the word rare and  
21 endangered, do you also use the word threatened?

22 A. Yes, I do.

23 MR. CASSIDY: It's been a while since  
24 I've had the pleasure of appearing before the Board.  
25 My memory is rusty as to when you break. Is it ten

1 o'clock?

2 MADAM CHAIR: 10:10, Mr. Cassidy.

3 MR. CASSIDY: 10:10. Thank you.

4 Q. If I could move on then to Section  
5 2.4 of your evidence, Dr. Schiefer.

6 This also can be found on page 14, Madam  
7 Chair and Mr. Martel, entitled: Harvest Operations.

8 And in this portion of your evidence, I  
9 would like to have you express your opinion on the  
10 ability of the fish guidelines and the code of practice  
11 to minimize the impacts on aquatic values caused by  
12 harvest operations. Could you please provide that to  
13 the Board?

14 DR. SCHIEFER: A. Yes. Members of the  
15 Board, the Fish Habitat Guidelines and the Code of  
16 Practice impose clear constraints on harvesting  
17 operations in a number of respects. These are  
18 summarized on page 16 in the statement of evidence, and  
19 I would like to just quickly go through them.

20 There is a prohibition against  
21 clearcutting and shelterwood cutting in areas of  
22 concern around all trout lakes and cold water streams.  
23 In these situations the only options are selection  
24 harvesting or no harvesting at all, the requirement  
25 that special equipment and contoured furrows be used on

1 sensitive sites, the prohibition against landings  
2 within identified areas of concern, the requirements  
3 for avoidance of repeated skid trail use and of  
4 skidding along slope contours, and the restrictions on  
5 seasons of operation, equipment type, residual debris,  
6 cut frequency and duff removal on slopes.

7 It is my opinion that adherence to these  
8 provisions of the guidelines and the code of practice  
9 should limit the risks of erosion, changes in water  
10 yield and temperature and debris in nutrient input to  
11 adjacent waters from timber harvesting.

12 In combination these should provide  
13 adequate protection of aquatic resource from the risks  
14 of adverse harvesting effects. One of the most  
15 effective mitigation measures in the Fish Habitat  
16 Guidelines are the provisions of buffer zones.

17 Q. All right. And if we can then move  
18 on, Dr. Schiefer, in referring to buffer zones, if we  
19 could move to the next section of the evidence found at  
20 page 17, Madam Chair, Mr. Martel in respect of buffer  
21 zones, and carry on to page 18.

22 If you could summarize your evidence in  
23 respect to buffer zones, Dr. Schiefer?

24 A. Yes. The Fish Habitat Guidelines  
25 provide for 30-metre to 90-metre buffer zones in areas

1 of concern depending on slope. We provided some  
2 additional references on the value and effectiveness of  
3 buffer zones from various recent studies, which I won't  
4 go into detail now, but they are discussed on pages 17  
5 and 18.

6 But I would summarize them by stating  
7 that buffer zones are effective in filtering and  
8 reducing overland transport of water-borne materials  
9 from cut areas and are clearly effective in reducing  
10 bank erosion, they minimize potential changes in water  
11 temperature regimes, and provide riparian cover for  
12 aquatic species.

13 However, the necessary width of buffer  
14 zones to accomplish these benefits appears to be  
15 variable with site conditions and the attendant  
16 benefit. One example would be water temperature  
17 regulation. Research, and a considerable amount of  
18 research in this area, has shown that the water  
19 temperature regulation benefit of stream-side  
20 vegetation is fully accomplished by a buffer zone as  
21 little as 10 metres wide. Other benefits may require a  
22 greater or lesser buffer zone width.

23 It is my opinion that the 30-metre to  
24 90-metre buffer zone called for in the guidelines and  
25 based strictly on slope could be overly conservative in

1 protecting intended aquatic resource values in some  
2 cases.

3 On this topic there is an interrogatory  
4 from the Ministry of Environment, Interrogatory No. 10  
5 on the concept of overprotection which I would like to  
6 address.

7 MR. CASSIDY: And I have copies of that,  
8 Madam Chair. (handed)

9 MADAM CHAIR: That will be Exhibit 1227.

10 ---EXHIBIT NO. 1227: MOE Interrogatory No. 10 re  
11 OFIA/OLMA Panel 9A.

12 DR. SCHIEFER: The Ministry of  
13 Environment Interrogatory No. 10 asked the question:

14 "To define what is meant by overprotect  
15 in the context of this statement?"

16 And, secondly:

17 "Can overprotecting a value result in  
18 unacceptable environmental effects?"

19 MR. CASSIDY: Q. All right. The  
20 statement that is referred to in this interrogatory, is  
21 that found on page 19 of your evidence where it states  
22 that:

23 "Conservative buffer zones by definition  
24 will overprotect in some cases."

25 Could you please summarize this answer

1 for the benefit of the Board?

2 DR. SCHIEFER: A. Yes. In this context,  
3 the term overprotect is used from the perspective of  
4 other resource uses and values. If the measure adopted  
5 to protect one resource use or value, in this case the  
6 aquatic environment, go beyond what is actually  
7 required to ensure such protection, for instance, are  
8 overly conservative, to the point where other resource  
9 uses and/or values are diminished, in this case  
10 harvestable timber, one may argue that the measures  
11 taken overprotect the first resource use or value when  
12 viewed from the perspective of the second resource use  
13 or value.

14 In this case protective measures beyond a  
15 certain point have little additional benefit for the  
16 protected resource use or value, while they may have  
17 increasing negative effect on other resource uses or  
18 values. And I think the drawing I provided earlier,  
19 Exhibit 1225, provides an example of that particular  
20 concept.

21 In response to the second part of that  
22 question, overprotecting a value will not result in an  
23 unacceptable environmental effect on the protected  
24 value, but could on other resource use values as  
25 discussed in the first part of the response.

1 MR. CASSIDY: If I could just have a  
2 minute.

3 Q. Dr. Schiefer, could you go back and  
4 briefly summarize the range of criteria that could be  
5 used in addition to slope in determining buffer zones?

6 DR. SCHIEFER: A. Yes. Our experience  
7 supports the need for and the value of buffer zones;  
8 however, buffer zone requirements should be tailored to  
9 site conditions for optimum results.

10 The buffer zones recommended in the  
11 guidelines are based entirely on slope, while other  
12 considerations such as soil type, moisture retention,  
13 ground vegetation, canopy cover, microtopographic  
14 relief, slope breaks and the existing or the expected  
15 degree of disturbance should be considered in  
16 determining appropriate buffer zone width in specific  
17 sites.

18 MR. CASSIDY: That completes Dr.  
19 Schiefer's evidence, Madam Chair, and I think we are  
20 now in a position to proceed with Mr. Craig's evidence.

21 And on the assumption we're breaking at  
22 10:10, what I propose is that Mr. Craig has a number of  
23 introductory comments, that will take us to 10:10, and  
24 then get into the body of his evidence, and having a  
25 look at the clock I'm somewhat optimistic that we might

1 finish this examination-in-chief by twelve noon. So,  
2 here's hoping.

3 If I could then move to -- and I don't  
4 mean to put any time frame on Mr. Craig, but at the  
5 same time I wanted to advise counsel for the other  
6 parties that they should be in a position to be  
7 prepared to cross-examine this afternoon, as I think I  
8 have already indicated in the hallway conversations.

9 Q. Mr. Craig, if I could then move to  
10 your evidence which, for the Board's benefit, is  
11 Section 3 of the Exhibit 1222 which commences at page  
12 20 and in fact runs through to the conclusion of this  
13 witness statement at page 82.

14 And I understand -- I'm going to ask you,  
15 as I asked Dr. Schiefer and Dr. Eedy, to summarize your  
16 evidence at the outset for the benefit of the Board,  
17 and I understand in doing that you wish to refer to  
18 some principles which are needed to understand the  
19 basis of your evidence.

20 MR. CRAIG: A. Thank you. Madam Chair,  
21 Mr. Martel. Indeed when I have been -- while preparing  
22 my evidence I have looked at the perspective of the  
23 application of pesticides onto a terrestrial  
24 environment and essentially following the potential  
25 fate and route of those pesticides into a water

1 environment. So that is the continuum that I have  
2 looked at, direct and indirect effects on the  
3 terrestrial area and direct and indirect effects on the  
4 aquatic environment.

5 I have reviewed the potential effects of  
6 these chemicals on consequently terrestrial life,  
7 mammals, insects and in the aquatic environment again,  
8 insect species and fish as a general rule.

9 What I think is critical to appreciate in  
10 viewing this chemical introduction and then fate is to  
11 understand some fundamental principles of toxicology  
12 because just because a compound is present does not  
13 necessarily mean it is toxic. And perhaps Mr. Cassidy  
14 I could use my points that I've drafted.

15 MR. CASSIDY: I think there's an easel  
16 drawing again which Mr. Craig has drawn this morning  
17 which he wishes to refer to, and we might enter as the  
18 next exhibit right at the outset. And if it could be  
19 marked as Exhibit 1228 and titled: Principles of  
20 Toxicology, Madam Chair.

21 MADAM CHAIR: Yes, Mr. Cassidy.

22 ---EXHIBIT NO. 1228: Hand-drawn diagram by Mr. Craig  
23 entitled: Principles of  
Toxicology.

24 MR. CRAIG: I have identified five, what  
25 I have called, principles of toxicology because I feel

1       it's important to have an appreciation of these five  
2       principles in order to understand what effects might  
3       occur when pesticides are applied to a receiving  
4       environment.

5                   The first principle is that of threshold  
6       effect concentration, and that is the concentration of  
7       a chemical that will produce an effect to a receptor  
8       organism. Now, you must appreciate that of course  
9       chemicals can be present in an environmental system in  
10      any media, either air or soil or water, at a range of  
11      concentrations from non-detectable to some measurable  
12      concentration; consequently there are concentrations --  
13      there is a potential for a concentration to be present  
14      that would be below that required to produce an effect,  
15      and that effect might be mortality, which is the most  
16      commonly referred to response, but it could also be a  
17      sublethal response such as reproduction or growth. And  
18      the reason it's called sublethal is that the exposure  
19      concentration will produce an effect but it will not  
20      produce death.

21                   So, for instance, in a community  
22      perspective if a community of organisms is exposed to a  
23      chemical where their reproductive capabilities are  
24      impaired or their growth is stunted, then they would be  
25      less successful in competition with other communities

1 and other organisms. So it's referred to as a  
2 sublethal effect and it can be an important effect.

3 MR. CASSIDY: Q. So is your discussion  
4 of toxicity then that we'll be dealing with this  
5 morning confined to just lethal or deadly effects?

6 MR. CRAIG: A. No. I will be referring  
7 to sublethal effects as much as lethal and I believe  
8 that the sublethal effects are important on the long  
9 term, but I will be referring to both types of effects.

10 The other principle is that of exposure  
11 duration and the key there is that it is not so much a  
12 matter --

13 ---Discussion off the record

14 The second item is that of exposure  
15 duration. So that it is just as important to  
16 understand how long the concentration has been present  
17 in the media and the duration of the exposure to  
18 determine the effect. For instance, it's possible that  
19 a pesticide could exceed the threshold of sublethal  
20 response or lethal response yet be present for such a  
21 short duration that that response would not be  
22 triggered. So that is another important consideration.

23 Thirdly, the principle of chemical  
24 structure is key. The pesticides in this case we're  
25 considering today are designed, they are engineered to

1 be effective on a target organism, and this means that  
2 they have been chemically structured to provide a very  
3 good fit to a sensitive receptor site in the target  
4 organism. Many, many chemicals have been evaluated and  
5 the structure has been redesigned chemically so that  
6 these compounds will be the most effective for that  
7 target organism.

8 So the design, the number of molecules,  
9 the kinds of molecules, the relative position of the  
10 molecules, the atoms in these molecules are all very  
11 critical to structure, and the better the fit the  
12 better the structure, the better the activity or the  
13 toxicity.

14 Fourthly, there is the item of  
15 persistence. And these chemicals once they have been  
16 introduced into the environment will not just stay the  
17 way they have been introduced forever, they are  
18 introduced into a complex environment that includes  
19 physical interactions of temperature and water,  
20 chemical interactions of various pH regimes, the  
21 presence of other compounds like just organic carbon  
22 for instance that will absorb these compounds, and then  
23 the bacterial component of just ubiquitous bacteria  
24 that are present in the world that we live in, the  
25 soil, the air, the water, and these bacteria will spew

1 the chemical as a source of carbon, for instance, and  
2 will be capable of not only breaking these compounds  
3 down into very small subsections but actually using the  
4 carbon as a source of substrate.

5 So persistence can be measured and can be  
6 measured under standard laboratory testings conditions,  
7 it can also be measured in the field. It's typically  
8 measured and expressed as half-life, and that is the  
9 time required for that chemical to decrease in  
10 concentration to 50 per cent of what it was at time  
11 zero. And on that basis then there is a common basis  
12 of comparison for the stability of one compound to  
13 another compound, for instance.

14 The International Joint Commission has  
15 identified that a compound might be considered  
16 persistent if it's half-life is greater than 8 weeks  
17 for instance, as a guide.

18 Finally the fifth item is that of  
19 bioconcentration or bioaccumulation. A chemical that  
20 is introduced into the environment does have the  
21 opportunity to be ingested by organisms, it can be  
22 absorbed by organisms, and the measure of the  
23 concentration in the organism compared to the  
24 concentration in the media provides a ratio, and that  
25 ratio is the bioconcentration factor or bioaccumulation

1 factor, either one.

2 The bioconcentration is referred to as  
3 direct uptake by the organism from the media into its  
4 body; bioaccumulation can include direct and indirect  
5 sources, for instance from, in the case of fish, from  
6 water and from food, but they can be expressed as  
7 factors.

8 The degree to which a compound will  
9 accumulate is going to be dependent once again on  
10 structure because some of these compounds are designed  
11 to be lipid soluble and, therefore, they will tend to  
12 be more soluble in fat than they will be in other body  
13 fluids like blood for instance and tissue, and  
14 consequently if they are lipid soluble, they will  
15 accumulate to higher concentrations. And we will talk  
16 more about that.

17 If a chemical has a bioconcentration  
18 factor of less than one, it indicates that the compound  
19 is not lipid soluble and in fact there is some  
20 resistance to the compound entering into the organism,  
21 there is some selection against accumulation.

22 So as we go through the various  
23 components of my evidence I will be referring back to  
24 many of these principles, and the key thing I would be  
25 looking at is the exposure concentration in the

1 environment with regard to the threshold effect  
2 concentrations, that is how much chemical is required  
3 to produce effects, and not only is the concentration  
4 requirement met but also is the duration met.

5 MR. CASSIDY: Q. And those effects would  
6 be either sublethal or lethal?

7 MR. CRAIG: A. And that would be for  
8 either of those effects, lethal or sublethal, that's  
9 correct.

10 MR. CASSIDY: With that introduction  
11 complete, we would then move after the break to a  
12 discussion of herbicides, followed by a discussion of  
13 insecticides, and since it's 10:09 a.m. I think it  
14 would be appropriate to break now until --

15 MADAM CHAIR: 20 minutes, Mr. Cassidy.

16 MR. CASSIDY: 10:30 -- 10:29?

17 MR. FREIDIN: 10:29.

18 MR. CASSIDY: Thank you.

19 MADAM CHAIR: Thank you.

20 ---Recess taken at 10:09 a.m.

21 ---On resuming at 10:30 a.m.

22 MADAM CHAIR: Please be seated.

23 MR. CASSIDY: Madam Chair, Mr. Craig  
24 wishes to refer the Board to a diagram he's drawn this  
25 morning on the easel, just before he commences his

1 detailed evidence in respect of herbicides and  
2 insecticides, which will explain, I understand, some of  
3 these principles graphically.

4 MR. CRAIG: Madam Chair, Mr. Martel.  
5 Just to follow on the items I identified before, I  
6 thought I would present an illustration of some of  
7 those principles that I've mentioned.

8 I've developed a graph here which on the  
9 "y" axis has concentration, and this could be for any  
10 chemical, and on the "x" axis I have identified the  
11 component of time.

12 MR. CASSIDY: If you could just stand a  
13 little to the -- that's better.

14 MS. SEABORN: Thank you.

15 MR. CASSIDY: So all the parties can see.

16 MR. CRAIG: I've developed four  
17 scenarios. Each of these lines represents the  
18 application of a chemical at some time and in the  
19 environmental compartment, and this could be any; land  
20 water, air, whatever, of course the concentration would  
21 go from non-detectable up to some level and then it  
22 would decrease, and I've developed what I consider a  
23 typical decay curve where many of the principles of  
24 degradation which are referred to in discussion of  
25 persistence would take place.

1                   The four scenarios I've labeled A, B, C  
2                   and D and the scenario A, which is a very low level  
3                   application as you can see -- first of all, I will just  
4                   back up.

5                   I've drawn on this chart two lines on the  
6                   concentration scale. The lowest one, the one closest  
7                   to zero that runs horizontally across the graph is  
8                   labeled sublethal and, of course, sublethal effects are  
9                   more sensitive, that means that they require less  
10                  concentration to produce that effect and so, therefore,  
11                  any chemical that crosses its respective sublethal  
12                  threshold limit, of course, should produce a sublethal  
13                  effect given the principles of duration as well as  
14                  concentration, and at a much higher concentration as  
15                  identified the line or the threshold lethality. So  
16                  again, in order for a chemical or a pesticide to be  
17                  lethal to a receptor organ, it must also cross -- it  
18                  must cross the lethal threshold concentration for that  
19                  compound.

20                 So to return, I've identified scenario A  
21                 as to be an application of a chemical that increases  
22                 above non-detection and goes to a certain point, which  
23                 is below the sublethal threshold, and decays down and,  
24                 in this case of course there would be no effect on  
25                 either target or non-target organisms.

1 MR. CASSIDY: Q. When you say it goes to  
2 a certain point, you mean that the concentration  
3 reaches a certain point?

4 MR. CRAIG: A. That's right, but it  
5 would be below the sublethal threshold, the  
6 concentration level for that respective chemical for  
7 respective organisms, because different organisms will  
8 have different sensitivities and we'll see  
9 illustrations of that.

10 In scenario B I've identified the  
11 application of a chemical that has resulted in a higher  
12 environmental concentration than that of A and indeed,  
13 in this case, crosses the sublethal threshold line and  
14 decays down. So the critical component of this  
15 exposure then is the area that passes the sublethal  
16 line and I've stippled this with little dots.

17 And so this area then is critical if this  
18 area, that is the extent of concentration, exceeds over  
19 the sublethal line, and also the duration of that  
20 excedence then becomes critical in determining whether  
21 or not a sublethal effect was manifested.

22 Q. That's scenario B?

23 A. That's scenario B, Madam Chair.

24 In the case of scenario C I've identified  
25 an even greater exposure application and, in this case,

1 the line just cuts over, just exceeds the lethal  
2 threshold limit and one can see two things here: No.  
3 1, that the area under the curve that exceeds the  
4 lethal line is very, very limited; however, the  
5 sublethal -- the area of the curve that exceeds the  
6 sublethal threshold is much larger. So for scenario C  
7 the probability that a sublethal effect would be  
8 elicited is much greater for scenario C than would be  
9 expected for scenario B, as you can see from the  
10 difference in the two areas under the curve.

11 Finally, in scenario D I've identified  
12 the highest concentration, highest application that one  
13 might anticipate in this representative example. Not  
14 only does scenario D exceed the lethal limit but it  
15 does so for some period of time and, therefore, one  
16 might anticipate there would be a lethal response for  
17 respective organisms and, of course, the area for  
18 sublethality effects is much greater for scenario D  
19 than either C or B.

20 So this illustration focuses on the  
21 principles of not only concentration but also duration  
22 and whether or not various types of effects might be  
23 expected.

24 Q. All right. If you wish to then move  
25 on to the next diagram.

1 A. The next diagram.

2 MR. CASSIDY: Before we do that, I think  
3 it would be appropriate to mark that diagram as Exhibit  
4 twelve twenty...?

5 MADAM CHAIR: Nine.

6 MR. CASSIDY: Nine. And what would you  
7 call that diagram, Mr. Craig?

8 MR. CRAIG: Illustration of concentration  
9 and exposure.

10 MR. CASSIDY: Hand-drawn diagram of  
11 illustration of concentration and exposure.

12 ---EXHIBIT NO. 1229: Hand-drawn diagram of  
13 illustration of concentration and  
exposure by Mr. Craig.

14 MR. CRAIG: My final illustration is that  
15 to demonstrate the aspect of structure toxicity effects  
16 or structure activity and, in this case, I've used a  
17 diagram to identify a chemical - it could be any  
18 chemical - it has a squiggly line of various atoms on  
19 it and it has a key element, typically at one end of  
20 the chemical, which is engineered to fit a specific  
21 receptor.

22 And I've drawn the receptor as a square  
23 notch and you can see that the active end of the  
24 chemical in this case is a square, and you can see that  
25 with a well engineered chemical designed specifically

1 for a particular receptor you get a very good fit.  
2 This square fits into that notch very nicely and,  
3 consequently, you can generate or expect a high degree  
4 of efficacy for this chemical on this receptor site.

5 So, for instance, in herbicides this  
6 would be a herbicide and this would be a plant receptor  
7 site and would produce a very good fit, sort of an  
8 economical way to use the chemical in that regard. The  
9 same with insecticides, you get good effect for a  
10 limited amount of chemical used.

11 In the lower part of the illustration I  
12 have identified the same chemical, it's got the  
13 squiggly line and the active end, the square active end  
14 but in this case we have a different kind of receptor  
15 and I've drawn a circular receptor here and one can see  
16 that this square is not going to fit in this circle  
17 very well and this is a poor fit.

18 This would be typical of what you would  
19 expect for a non-target organism. So it just makes it  
20 very, very difficult for this chemical to have the same  
21 kind of effect, whether it would be a lethal effect or  
22 a sublethal effect, on a non-receptor organism that  
23 does not have the same kind of receptor as the target  
24 organism would have and, consequently, you tend to see  
25 that this chemical has a lower lethality concentration

1 or, let's say, it's less toxic, takes more of the  
2 chemical to produce mortality, takes a lot more  
3 chemical to produce a sublethal effect. It's just not  
4 a very effective chemical for organisms that it wasn't  
5 designed to interact with.

6 MR. CASSIDY: And we can mark that as  
7 Exhibit 1230; is that correct, Madam Chair?

8 MADAM CHAIR: Yes, Mr. Cassidy.

9 MR. CASSIDY: And what would you call  
10 that, Mr. Craig, hand-drawn diagram of...?

11 MR. CRAIG: This would be an illustration  
12 of structure activity relationships, or let's say  
13 structure toxicity relationships.

14 MR. CASSIDY: Structure toxicity  
15 relationships. Thank you.

16 ---EXHIBIT NO. 1230: Hand-drawn diagram of structure  
17 toxicity relationships by Mr.  
Craig.

18 MR. CASSIDY: Q. I understand now you  
19 wish to move to a discussion regarding herbicides?

20 MR. CRAIG: A. Yes, thank you, Madam  
21 Chair.

22 Q. And I understand it may be necessary  
23 for you to refer back to some of these graphs and  
24 drawings to illustrate the principles in the course of  
25 your evidence; is that correct?

1 A. Yes, that's correct, Mr. Cassidy.

2 MR. CASSIDY: All right. Then if we  
3 could move to the discussion on herbicides, Madam  
4 Chair, which commences at page 20.

5 Q. And, first of all, could you advise  
6 the Board of the herbicides that you will be discussing  
7 in your evidence?

8 MR. CRAIG: A. Madam Chair, Mr. Martel,  
9 I would like to deal with the herbicides glyphosate,  
10 2,4-D, hexazinone, simazine, and picloram.

11 Q. And could you provide the Board with  
12 the conclusions that you have arrived at with respect  
13 to the environmental persistence of those herbicides?

14 A. Yes. A number of studies have been  
15 conducted on these compounds where they have been  
16 introduced into natural environment systems, natural  
17 receiving environments and the half-life of these  
18 compounds have been measured, where possible, and in  
19 other cases observations have been made in the field by  
20 measuring those compounds at various points in time.

21 In general they are all degradable and  
22 the period of time required for them to degrade will  
23 differ, but in general they are typically fairly short;  
24 that is, they do not persistent for ever and ever, they  
25 do degrade and, in the case of glyphosate, we have

1 identified references that refer to several weeks in  
2 soil for instance; for 2,4-D, days to several weeks;  
3 hexazinone, a month or less; and in the case of  
4 picloram, several months, but it is unique in that it  
5 is injected into plants and, therefore, the opportunity  
6 for dispersion is limited; simazine is persistent in  
7 soil and water, however, it is readily metabolized and  
8 excreted by mammals and non-target organisms.

9 And the other factors that we considered  
10 dealing with persistence was that of bioconcentration  
11 or bioaccumulation as I discussed earlier, and reports  
12 are that these compounds will be taken up by organisms.  
13 The best examples are that of fish accumulating these  
14 compounds from water and the factors of accumulation  
15 are very low, that is they're in the order of tens  
16 perhaps, but in some cases they are actually less than  
17 one as I indicated before in my discussion. A factor  
18 less than one indicates that less of the chemical ends  
19 up in the organism than was in the water for instance.

20 This is also consistent with the  
21 structure and the design of these compounds, they are  
22 not fat soluble or lipid soluble and so, therefore,  
23 they tend not to accumulate to high concentrations in  
24 organisms nor do they travel through the food chain  
25 effectively.

1 MR. CASSIDY: For the benefit of the  
2 Board, there is, in addition to the detailed discussion  
3 in this witness statement, the conclusions are captured  
4 on pages 28 and 29 with respect to persistence of the  
5 witness statement, if you wish to note those pages.

6 Q. If we could then move to page 29 for  
7 the discussion of the direct toxic effects on  
8 terrestrial animals. And if you could please summarize  
9 your conclusions with respect to that topic, as well as  
10 explain the process of analysis that you went through?

11 MR. CRAIG: A. Yes. Madam Chair, the  
12 assessment of toxic effects on terrestrial animals is  
13 in large part conducted by the use of mammalian tests,  
14 rodents tests perhaps and various other different kinds  
15 of mammals by determining the dose required in feeding  
16 experiments or water experiments to elicit a certain  
17 type of response, rather the lethality or some  
18 indication of sublethal impairment like reproductive  
19 impairment.

20 Q. That gets back to Exhibit 1228?

21 A. That was the list of principles; was  
22 it?

23 Q. No, I'm referring to the graph that  
24 you drew. 1229, sorry.

25 A. 1229 is the graph.

1 Q. All right.

2 A. But that is a good illustration of  
3 those two end points. And because these surrogate  
4 models have been shown to be good representatives of  
5 some of the wildlife that we have to be concerned with,  
6 there is an opportunity to look at the dose consumed  
7 with regard to the response of concern, mortality or  
8 sublethal effects.

9 The intake is measured as milligrams of  
10 compound per kilogram of body weight and consequently  
11 it's possible then to look at a range of these response  
12 concentrations or feeding regimes and then relate that  
13 back to some other mammal of interest. And typically  
14 rodents, for instance, might be used for -- well, a  
15 range of rodents, is what I meant, would be used and  
16 more sensitive responses would be used as indicators.

17 So in conducting these comparisons  
18 exposure levels of glyphosate to animals, for instance,  
19 were five times lower than what would be required to  
20 elicit an effect, and again I come back to the exposure  
21 versus the required dose, and that tends to be a five  
22 times lower factor for glyphosate.

23 In the case of 2,4-D a very large body  
24 dose is required and the examples that we used in the  
25 evidence was that for rabbits and bears, and the

1 factors were many, many times their body weight and to  
2 our minds seemed virtually impossible for these animals  
3 to consume that many times their body weight in one  
4 day, each day, to achieve the dose required to produce  
5 a detrimental effect. So there is a practical  
6 limitation to the toxicity of 2,4-D.

7 This is based -- of course, all of these  
8 studies are based on the utilization of approved  
9 application rates for these herbicides. So that is an  
10 important component of the evaluation.

11 In the case of hexazinone and simazine,  
12 again we found that those residue levels were all below  
13 levels in surrogate studies found at toxic, and toxic  
14 can be either lethal or sublethal for those animals.

15 And I think that really serves to  
16 illustrate the point that if the chemical is not  
17 designed well to elicit a response in a non-target  
18 species that makes it very difficult to produce that  
19 response. So herbicides then tend to be poor animal  
20 toxicants and this information illustrates that very  
21 well.

22 MR. CASSIDY: For your reference, Madam  
23 Chair, Mr. Martel, these conclusions are detailed on  
24 page 33 and 34 of Exhibit 1222.

25 Q. And if I can move on, Mr. Craig, to

1 the next portion of your evidence dealing with the  
2 indirect effects on terrestrial animals due to  
3 alterations in vegetation food and cover. That's  
4 Section 3.1.3, Madam Chair.

5 This can be found on page 34 through to  
6 page 36 where the conclusions can be located at the top  
7 of page 37. I understand that, Mr. Craig, you will  
8 speak to this as well as Dr. Eedy.

9 MR. CRAIG: A. That's right. Madam  
10 Chair, we've acknowledged here that when herbicides are  
11 used in a terrestrial environment of course there will  
12 be some plants that will be affected and, therefore,  
13 the effects of that reduced vegetation is an indirect  
14 effect, and I think Dr. Eedy can better address that  
15 aspect of various animal community responses when that  
16 foliage is reduced.

17 DR. EEDY: A. Yes. Madam Chair and Mr.  
18 Martel, I will just speak in summary form to the  
19 effects basically of the indirect effects through how  
20 the herbicides affect the browse and understorey  
21 vegetation which could be used as either browse food or  
22 as habitat for ground-dwelling species.

23 We've reviewed the evidence in this -- on  
24 this basically relating to the larger herbivores like  
25 the moose and deer and the smaller animals which may be

1 using this as either habitat or as food, being birds  
2 and small mammals.

3 Basically the evidence that we have  
4 reviewed has not been totally conclusive and at times  
5 has been contradictory. In general my conclusion from  
6 this evidence has been that it tends to show that what  
7 effects do occur are relatively insignificant, they  
8 don't show gross either adverse effects or gross  
9 beneficial effects.

10 In general herbicides, as I understand  
11 they are used in timber management in Ontario, are  
12 applied in relatively low concentrations, and I speak  
13 relatively as compared to how they are applied in  
14 control of roadside vegetation or agricultural use.  
15 Foresters are attempting to suppress but not  
16 necessarily kill all the vegetation, they want to  
17 basically knock back the broadleaf plants so that the  
18 conifers or the crop species can get a chance to get  
19 ahead of these, and basically they don't want to use  
20 too much because if they use too much they would, as a  
21 herbicide, affect all of the vegetation and could  
22 potentially kill their crop.

23 I understand that such applications are  
24 usually in the early periods of reforestation when the  
25 conifers are quite small and they want to get them up

1 above the undergrowth broadleaf species, and usually  
2 these are not used more than two to three times in the  
3 60 to 80-year cycle of reforestation within the forest.

4 Within these sort of broad concepts the  
5 data that are referred to on pages 34 to 37, or Section  
6 3.1.3 of our written evidence which has been entered as  
7 Exhibit 1222, indicate that effects on a variety of  
8 wildlife species are minimal and short term over the  
9 period in which any effect of herbicide on the plants  
10 can be shown, including the period of initial  
11 suppression of broadleaf plant growth, and then  
12 ultimately a period of recovery of this understorey  
13 broadleaf growth or what can be termed as either browse  
14 or habitat.

15 It is my opinion that the effects on  
16 wildlife food and habitat are minimal and at the same  
17 time being at certain times during this period both  
18 potentially adverse to a small extent and potentially  
19 beneficial to a small extent; consequently, I believe  
20 the overall effect more or less balances out.

21 MR. CASSIDY: If we could then move on,  
22 Madam Chair, and move to page 37 of the witness  
23 statement dealing with the direct toxic effects on  
24 fish.

25 Q. And if I can come back to you, Mr.

1 Craig - Madam Chair, this is captured on pages 37  
2 through 42 - and I would ask Mr. Craig now to recount  
3 for us the essence of those pages for the benefit of  
4 the Board.

5 MR. CRAIG: A. Madam Chair, Mr. Martel,  
6 the effects of these herbicides in aquatic environments  
7 has been measured in some field studies where there  
8 have been spray applications in some cases and either  
9 adjacent or actually over various streams, and the  
10 water concentrations in these studies have been  
11 measured and observations in the field, in the stream  
12 have been measured as well.

13 Also there have been some laboratory  
14 studies conducted where some precise measures of lethal  
15 and sublethal effects could be determined as well. So  
16 there is a wide body of evidence available.

17 Again, as I've mentioned before,  
18 herbicides are not particularly effective on mammals,  
19 they are not particularly toxic to fish given the types  
20 of exposure concentrations fish would experience in a  
21 typical spray application and as evidence of that  
22 glyphosate was found to be present in stream -- in  
23 streams at one tenth of the concentration required to  
24 produce lethality in fish and no significant sublethal  
25 impacts were observed in fish after glyphosate

1 application.

2 Similarly with 2,4-D and hexazinone, the  
3 concentrations measured in stream for 2,4-D were 1,000  
4 times below those concentrations required to produce  
5 detrimental effects in fish and for hexazinone 10,000  
6 times lower than that required to produce detrimental  
7 effects.

8 In the case of simazine, the comparison  
9 of expected concentrations in water with that of  
10 laboratory tests would indicate that fish would not be  
11 affected and clearly the bioaccumulation studies  
12 conducted with simazine indicates that fish tend to  
13 select against the uptake of this compound.

14 The other factor that is important in  
15 considering effects of these herbicides to fish is that  
16 of pollution. It is a fact that when herbicides or any  
17 chemical is applied, whether it be applied in the  
18 terrestrial zone and allowed to enter into a waterway,  
19 a surface water, it will be transported by a dilution  
20 effect, say with runoff, rain water runoff.

21 In the scenario where there would be a  
22 direct application, that is an overspray situation,  
23 there is also an opportunity for dilution and, as an  
24 example, I have conducted some rough calculations to  
25 indicate that for every 10 centimetres of water depth

1 and a pesticide landing on that surface area there  
2 would be a 10-fold dilution available for every 10  
3 centimetres, that's about four and a half inches of  
4 water depth. For every metre there is an available  
5 100-fold dilution, and that assumes a static system.

6 Now, if that water were flowing and if it  
7 were flowing at a very slow rate, for example one metre  
8 a minute, which is a little more than three feet, so it  
9 would take the water one minute to travel all hundred  
10 centimetres, which is pretty slow, there is another  
11 ten-fold dilution available. So a combination of flow  
12 and depth afford greater levels of safety with regard  
13 to exposure, particularly to non-target organisms.  
14 This also -- these principles also of course will apply  
15 for insecticides.

16 So that explains in some part probably to  
17 a large degree the reason why we see a range of  
18 concentrations which are 10 to 10,000 times below  
19 effect concentrations in waterways in the case of these  
20 herbicides.

21 Q. Is that sublethal effect  
22 concentrations?

23 A. That's right. The range includes  
24 both lethal and sublethal effects. As a result, buffer  
25 zones that have been discussed in earlier testimony

1       only provide additional protection for the aquatic  
2       environment because of the dilution factor available  
3       naturally.

4                   MR. CASSIDY: Can we then move to page  
5       43, Madam Chair, Mr. Martel, where Mr. Craig is dealing  
6       with the direct toxic effects on other aquatic  
7       invertebrates, and that can be found from page 43 --  
8       I'm sorry, 42 through to 47.

9                   Q. And could you summarize that evidence  
10      for us? You will note, Madam Chair, that as with the  
11      other sections, the conclusions are found at the end of  
12      each one of these and you can find those conclusions at  
13      pages 46 through 47 and I'd ask the witness to focus on  
14      the conclusions for the benefit of the Board and  
15      explain, where necessary, the more detailed evidence  
16      which is contained on those pages.

17                  MR. CRAIG: A. Madam Chair, the  
18      invertebrates that I'm referring to in the aquatic  
19      environment are in many cases the larval forms of  
20      flying insects, that's where they spend their first  
21      life stages, and then they emerge at a later date.

22                  There are also other invertebrates which  
23      would be present that would live their entire life in  
24      the aquatic environment, typically they're in the  
25      sediment, so they're at the bottom of the stream or the

1 pond or the lake, and except for -- there are some  
2 other invertebrate forms which will also live in the  
3 water column as well. So these are the invertebrates  
4 that we're referring to.

5 The toxicity tests that have been  
6 conducted in laboratory environments have demonstrated  
7 that these invertebrates that the fishery rely on for  
8 food are also quite tolerant of glyphosate, so the  
9 exposure concentrations anticipated would be very much  
10 lower than the detrimental effect concentration.

11 There have been some responses observed  
12 in field applications, which is referred to as  
13 drifting, and this is more common in streams, in that  
14 if an application occurs which is approaching this  
15 sublethal effect - and sublethal in this case refers to  
16 a behavioural response - and what can be seen is these  
17 organisms can actually, the bottom organisms can  
18 actually lift off the surface and they will just drift  
19 downstream to a concentration that would be lower and  
20 they can by in that means limit their concentration  
21 exposure and their duration exposure to that compound  
22 if they find irritable and, consequently, since  
23 behaviour tends to be a rather sensitive response, we  
24 would not anticipate that some of the more critical  
25 communities sustain sublethal effects such as

1 reproduction or would growth be affected.

2 A compensatory feature in a stream  
3 system, as Dr. Schiefer has referred to with fish, is  
4 that the upstream organisms can then recolonize in the  
5 areas that are depleted or reduced in population. So  
6 it's a very dynamic system and there is an opportunity  
7 for rapid re-establishment of those communities. So  
8 it's very much a transitory effect.

9 The studies conducted with 2,4-D,  
10 hexazinone and simazine, again, also clearly suggest  
11 that the concentrations in the field, based on other  
12 field studies, would be below effect concentrations,  
13 and field observations have also confirmed this  
14 conclusion.

15 So consequently, again we see that the  
16 utilization of buffer zones again just provides an  
17 additional component of safety over and above that  
18 already provided by natural dilution.

19 Q. Then if we could move to the Section  
20 3.1.7 commencing at page 47 of Exhibit 1222 entitled:  
21 Direct Toxic Effects on Aquatic and Terrestrial Plants.  
22 And would you summarize that section of the evidence  
23 which is contained therein?

24 A. Yes. Madam Chair, of course  
25 herbicides are designed to have an effect on

1       terrestrial plants, so of course the herbicides will be  
2       prepared and applied for a threshold response, so there  
3       is little doubt that there will be effect on those  
4       plants.

5                       In the case of glyphosate and the effect  
6       on some of the aquatic plants which could be  
7       macrophytes, that is the plants that stand well above  
8       the surface, there are also plants that will be  
9       somewhat submerged; that is, as they mature a component  
10      of vegetation will be above the water surface and more  
11      immature leaves and whatnot would be below the surface,  
12      also may have their roots in the sediment, and there  
13      are other floating plants which duckweed is a good  
14      example, and there are some plants that float quite  
15      freely in the water systems, their leaves and roots are  
16      in the water, roots at the surface -- I mean leaves at  
17      the surface perhaps.

18                     At any rate, in the case of glyphosate,  
19      there have been some observed reductions in chlorophyll  
20      a, and chlorophyll is essential to the plant to produce  
21      carbohydrate and food and food supplies, and again  
22      there is clearly an indication of dilution in the water  
23      system. If there is an overspray direct application,  
24      there is that safety allowance.

25                     And the only areas of vegetation in the

1 aquatic systems that we would anticipate would be most  
2 sensitive would be the vegetative components above the  
3 water and very close to the shore where there wouldn't  
4 be perhaps an opportunity for contact, but the root  
5 systems would enjoy the advantage of protection from  
6 the water and also the immature vegetation would have  
7 an opportunity to enjoy that water dilution effect as  
8 well.

9 So we would anticipate that where the  
10 herbicides are applied in accordance with the approved  
11 practices that aquatic plants would not be extensively  
12 impaired and, again, the buffer zone would provide the  
13 kind of protection that would be necessary at the very  
14 edge of the stream areas. In fact, field studies have  
15 identified that where there has been some damage in  
16 aquatic systems, the following year there has been  
17 clear recovery and, in some cases, increased growth in  
18 those areas. So any effects are minimal and they are  
19 certainly transitory.

20 MR. CASSIDY: Q. If we could then move  
21 to page 49, Madam Chair and Mr. Martel, dealing with  
22 the Effects on Groundwater which can be found at the  
23 bottom of that page and is numbered Section 3.1.8 and  
24 it continues on to page 50. And this would conclude  
25 the discussion on herbicides from Mr. Craig.

1 Q. And if you could please do that now,  
2 Mr. Craig?

3 MR. CRAIG: A. The concern we had or the  
4 interest we had with regard to herbicide in groundwater  
5 was that for another root of entry; that is, any  
6 terrestrial application of herbicide percolating  
7 through the soil and into the groundwater and then  
8 entering into a surface water system.

9 The studies that have been reported are  
10 for agricultural applications and they tend to receive  
11 higher doses and more frequent doses of herbicide. The  
12 reports have indicated for hexazinone and picloram and  
13 2,4-D, for instance, that in these worst case  
14 agricultural applications the herbicides were able to  
15 meet the -- enter into the water table only 10 per cent  
16 of the time, and field studies with hexazinone and  
17 picloram, when they were measured in the groundwater,  
18 were found to be below -- in the case of these studies,  
19 below the U.S. EPA water quality guidelines.

20 So while there is some opportunity for  
21 that root of entry there is, by necessity, a need for  
22 the herbicide to pass through a very active surface  
23 biomass and residual bacteria which promotes the  
24 degradation process, and where these studies have been  
25 conducted the actual concentrations and exposures have

1           been very low in the total guideline levels,

2                       MR. CASSIDY: That completes the  
3           discussion in respect of herbicides. If we could then  
4           move to what is effectively the second part of Mr.  
5           Craig's evidence dealing with insecticides, Madam  
6           Chair, and that commences at page 51 and is entitled:  
7           Section 3.2, The Use of Bacterial and Chemical  
8           Insecticides.

9                       Q. And I'd ask you to briefly summarize  
10          what this evidence is about, Mr. Craig, and perhaps you  
11          could commence in that fashion by referring the  
12          insecticides that you are going to discuss?

13                      MR. CRAIG: A. Madam Chair, Mr. Martel,  
14          the insecticides I would like to discuss in my  
15          testimony are the soil bacterium referred to throughout  
16          this hearing as B.t., to carbamate insecticides,  
17          aminocarb, carbaryl and an organophosphate insecticide,  
18          fenitrothion.

19                      The B.t. is of course a pathogenic  
20          organism and is particularly effective for the target  
21          pests. It is different from the other insecticides in  
22          that it is not a chemical, of course, and; therefore,  
23          it has somewhat different characteristics, it doesn't  
24          degrade or dissipate in the normal manner that  
25          chemicals degrade as I mentioned in my discussion with

1 the persistence; the opportunities of chemical  
2 structure, cleavage and metabolism and whatnot do not  
3 apply with this product. Also it is a ubiquitous  
4 bacteria and under ideal culture conditions it can  
5 indeed appear to persist for a longer period of time  
6 so -- than under other conditions, and so if there is a  
7 suitable environment then it will stay in that  
8 environment.

9 The carbamate insecticides are  
10 neurotoxins, they are particularly effective on insects  
11 and they will have somewhat similar effects on other  
12 organisms with similar nervous systems, so there is a  
13 need to review their effects in non-target areas.

14 Q. So you say it's a neurotoxin, I take  
15 it you mean it has an effect, either lethal or  
16 sublethal, on the nervous system of the target organism  
17 and other non-target organisms?

18 A. Yes. That's simply just the mode  
19 of -- I'm referring to the mode of action, but again  
20 all the principles of concentration and duration of  
21 exposure also apply and there is some specific--

22 Q. Specificity?

23 A. --specificity associated with insects  
24 that all other mammal systems would not enjoy as  
25 completely.

1 Fenitrothion acts in the same way as the  
2 carbamates and, consequently, there is a need to review  
3 those potential effects in other organisms that have  
4 the same systems.

5 MR. CASSIDY: Then can we move to the  
6 Section 3.2.2 found on page 52, Madam Chair, entitled:  
7 Environmental Persistence.

8 Q. And could you please summarize that.

9 MR. CRAIG: A. The bacteria B.t. and the  
10 carbamates and the organophosphates indeed do have  
11 short half-lives, again for different reasons, but B.t.  
12 does not have the chemical properties that would allow  
13 it to partition or accumulate in lipid systems, so  
14 bioaccumulation is not a factor and, as I said,  
15 longevity is determined very much on the conditions  
16 that it finds itself and, for instance, under fairly  
17 arid conditions the viability of spores increases  
18 rapidly.

19 For the other chemicals they will  
20 chemically degrade under alkaline conditions and in  
21 water, and so they naturally hydrolize. They can be  
22 metabolized by plants and animals and, consequently,  
23 there is a route of degradation in non-target organisms  
24 and also excretion, and so that reduces the toxicity of  
25 those compounds in other systems.

1                   Typically residues for these chemicals  
2           have become non-detectable within a month's time after  
3           application. So again, that attests to the  
4           degradation -- rate of degradation of these compounds.

5                   Some of the carbamates have very short  
6           half-lives in the order of 10 days, for instance.

7                   Q. Can you comment on the long-term  
8           effects of these in terms of persistence?

9                   A. The long-term effects from the  
10          chemicals per se would be somewhat limited because of  
11          the lack of accumulation in fat stores and the  
12          extremely limited opportunity for these compounds to  
13          travel through the food chain and, as I mentioned, the  
14          opportunity for bacterial degradation in soil,  
15          hydrolysis in water all go to reducing the persistence  
16          of these compounds.

17                   So they also tend to be fairly  
18          quick-acting for non-target -- for the target organisms  
19          so that, again, the opportunity to apply the proper  
20          application concentration and generate the desired  
21          effect within a short time means that the residuals  
22          decay quickly.

23                   MR. CASSIDY: And the conclusions in that  
24          regard are found on page 59 of the evidence, Madam  
25          Chair.

1 Q. Could we then move to page 60, Mr.  
2 Craig, where you discuss the Effects on Terrestrial  
3 Organisms, and could you indicate your conclusions in  
4 that respect?

5 That is Section 3.2.3, Madam Chair.

6 MR. CRAIG: A. Yes. These compounds of  
7 course are insecticides, they're designed to have  
8 effects on certain terrestrial organisms, specifically  
9 insects and related organisms.

10 The information that we gathered  
11 indicated that carbaryl and fenitrothion are toxic to  
12 bees and we have clearly identify a need for some  
13 additional consideration where these compounds would be  
14 applied close to apiaries. There is also a need to be  
15 aware that some other pollinators may be affected, but  
16 we've found in some longer-term studies with regard to  
17 forage base that these localized impacts would not have  
18 a long-term effect on higher food chain organisms like  
19 birds.

20 There have been certain indications that  
21 bird exposure to fenitrothion can have some effects;  
22 however, used at the approved rates studies of bird  
23 populations, their reproductive capability and some of  
24 their behavioural characteristics of food or tree  
25 while nesting and tending of young have indicated that

1           there is no measurable effect on these populations.

2                       And similarly with small mammals, while  
3           there has been some slight reductions in small mammal  
4           populations, there has been -- it has appeared as a  
5           very short-term type of effect and certainly recovery  
6           has been rapid and well established the next year.

7                       So as far as long-term effects are  
8           concerned, they seem to be extremely limited and there  
9           seems to be a good opportunity for recovery and that  
10          the most sensitive terrestrial group of organisms are  
11          those related to insects and, therefore, needs some  
12          special consideration.

13                      MR. CASSIDY:  If I could just have a  
14          minute, Madam Chair.

15                      If we could then move on to page 67, the  
16          conclusions again in that regard which are the essence  
17          of Mr. Craig is testifying about today can be found at  
18          page 66 with respect to terrestrial organisms.

19                      Q.  I understand, however, you wish to  
20          speak to the Board about Section 3.2.3.2 on page 67  
21          entitled:  Spray Availability, and you wish to speak to  
22          an interrogatory that was filed in that regard by the  
23          Nishnawbe-Aski Nation?

24                      MR. CRAIG:  A.  Yes, I would like to -- I  
25          think the most sensitive concern here is that if

1 insects or -- well, yes, insects are indeed affected  
2 directly with these insecticides because that is what  
3 these compounds are designed to do, and if the  
4 potential food base is reduced then there is always a  
5 possibility of that effect limiting the resources for  
6 small mammals and birds.

7 And the major compensating feature  
8 appears to be that the birds can indeed locate other  
9 areas that have not been affected or where the resource  
10 is sufficiently sustained that they can draw on that,  
11 and so there is a natural ability for birds to forage  
12 elsewhere. And similarly with small mammals, there is  
13 an opportunity to move out of the affected area into  
14 either less affected areas or not affected areas and  
15 cope in that regard.

16 Also the non-target insects that have  
17 been affected can -- those populations can be  
18 re-established by invasions from neighbouring  
19 communities. So again, as in the stream situation,  
20 there's a very dynamic set of interactions among  
21 communities and where various niches or areas have been  
22 reduced or even perhaps avoided, with the fairly rapid  
23 degradation of these chemicals as we have indicated  
24 earlier, there is an opportunity for those niches to be  
25 filled by the surrounding community insects.

1 MR. CASSIDY: Madam Chair, that  
2 interrogatory is Nishnawbe-Aski Nation Interrogatory  
3 No. 6 for this panel, and perhaps I can file it now and  
4 then ask the witness to identify the portion he wishes  
5 to have you refer to.

6 MADAM CHAIR: That will be Exhibit 1231.

7 ---EXHIBIT NO. 1231: Nishnawbe-Aski Nation  
8 Interrogatory Question No. 6 re  
OFIA/OLMA Panel 9A.

9 MR. CASSIDY: Q. Yes, Mr. Craig, if you  
10 could you just advise the Board of the relevant portion  
11 of that answer?

12 MR. CRAIG: A. The concerns were  
13 directed towards the potential transitory changes in  
14 terrestrial and aquatic non-target organisms with  
15 reference to carbaryl and those have been identified in  
16 studies which we cited in our witness statement as  
17 studies conducted by Barrett, 1988 and MacKenzie  
18 Winston, 1989.

19 And with regard to fenitrothion and its  
20 potential effects regarding prey availability, we have  
21 referred to studies conducted by Spray and colleagues  
22 in 1987 and Varty in 1977, and these too are cited in  
23 our reference list in the witness statement.

24 And with regard to a confirmation of  
25 recovery of prey from spraying with fenitrothion, we

1 are not able to identify specific studies, but we have  
2 relied on our understanding that fenitrothion is  
3 readily degradable and, therefore, would anticipate  
4 that once the level of chemical is below the critical  
5 effect concentration - I refer to our Exhibit 1229 -  
6 that once the chemical is below either the lethal level  
7 or the sublethal level for various uses that the insect  
8 would require, then of course that niche could be  
9 re-utilized by neighbouring organisms. Even though  
10 there may be some residual present, once below those  
11 effect concentrations re-invasion is successful, so the  
12 prey food base for the next level of organisms would be  
13 re-established.

14 Q. Can we then move to page 69 of the  
15 evidence dealing with the Effect on Aquatic Organisms,  
16 Section 3.2.4 of Mr. Craig's evidence. And could you  
17 please summarize that for the Board?

18 A. The aquatic invertebrates, as I  
19 mentioned before, are typically insect larval forms,  
20 they could be organisms that actually live in the water  
21 column and they are mobile, they can be mobile, some of  
22 them move pretty slowly, but others can take advantage  
23 of the current and streams and will travel slowly in  
24 the sediment.

25 In the case of the bacteria B.t. it's

1       been to be non-toxic to many; that is, of no lethal or  
2       sublethal effects for many large invertebrates.  
3       Invertebrates tend to be a little more resistant to  
4       some of these, particularly the bacterial type  
5       compounds in any case, and in the case of longevity,  
6       time to molting, for instance, these insects have to go  
7       through various instars of stages, they grow and they  
8       molt for instance, and the time for that type of  
9       transition, reproduction of invertebrates, a number of  
10      aquatic invertebrates such as, sort of beetle-like  
11      backswimmers, dragonfly, damselfly, larvae have been  
12      found to be unaffected by exposure to food, in this  
13      case, mosquito larvae that were actually infected with  
14      B.t.

15                      So that was a -- the study clearly  
16      indicated that there was a limited impact in that area.  
17      It can have some expressed toxicity on some of the  
18      insect species such as mosquito larvae and black  
19      flies, but for many of the other invertebrates such as  
20      snails, worms and crustaceans, beetles, dragonflies, it  
21      appears to be innocuous.

22                      In the case of aminocarb, and these are  
23      the carbaryl insecticides, again the effect of dilution  
24      on particularly a spray over situation is a clear  
25      advantage and this, a similar sort of drift response

1 has been observed with certain of these species and,  
2 again, there would be a relocation to another area of  
3 the stream which would have a lower exposure  
4 concentration. It limits the exposure duration as well  
5 as reducing the exposure concentration and, thereby,  
6 allows these organisms to relocate.

7 Also there is an opportunity once this --  
8 typically it's a peak concentration that's measured in  
9 a stream, once this peak is passed, there is an  
10 opportunity for re-invasion from upstream communities  
11 as will naturally occur and these niches then would be  
12 filled again and re-established.

13 Again with fenitrothion similar sorts of  
14 responses have been reported. Again, the same thing  
15 applies, there is an opportunity for recolonization,  
16 and I think referred even in the field studies where  
17 there have been these observations it's based on an  
18 approved concentration application and there's an  
19 opportunity for recovery.

20 So that the buffer zones that have been  
21 mentioned in other discussions would thereby provide  
22 that additional degree of safety that dilution in water  
23 systems would not provide and, as I mentioned, the  
24 depth and the current flow add to the degree of safety  
25 for any potential effects for aquatic invertebrates.

1 MR. CASSIDY: All right. If we could  
2 move to the Effect on Aquatic Invertebrates.

3 If I can just have a minute. I'm sorry,  
4 if we could move on to Effects on Aquatic and  
5 Terrestrial Plants which can be found at page 78, Madam  
6 Chair.

7 Q. And could you give your evidence in  
8 that regard, Mr. Craig?

9 MR. CRAIG: A. Yes.

10 Q. Go ahead.

11 A. Yes. Just a point of clarification,  
12 I'm not sure I jumped --

13 Q. All right. I think we jumped a  
14 section. I apologize, Mr. Craig. It might have been  
15 my mistake for being confused. All right.

16 A. I think --

17 Q. Can we go back to, I don't think  
18 you've completed your evidence in respect of aquatic  
19 invertebrates.

20 A. Or vertebrates. Madam Chair, I think  
21 I may have jumped to the Effect on Invertebrates and  
22 missed the vertebrates, fish effects.

23 Q. Get us out of the swamp first.

24 A. Let's stay in the water.

25 MR. CASTRILLI: Could you just identify

1       where --

2                   MADAM CHAIR:   Mr. Castrilli?

3                   MR. CASTRILLI:   I'm sorry, Madam Chair.

4       I simply wanted to know where my friend was in the  
5       witness statement.

6                   MR. CASSIDY:   Q.   I think we are -- well,  
7       Mr. Craig, perhaps you can indicate where you wish to  
8       go next in respect of that section?   Your a safer bet  
9       at this point than I am on that.

10                   I think you want to go to page 69; do you  
11       not?

12                   MR. CRAIG:   A.   That's correct.

13                   Q.   All right.   I apologize.

14                   A.   I'm sorry, I probably jumped ahead.

15                   If I can stay in the water system because  
16       all of the same principles apply, I think -- I believe  
17       I dealt with the invertebrates and now we will deal  
18       with the vertebrates, and these will include fish of  
19       course.

20                   And again, when we are looking at the  
21       effects on fish, B.t. was found to be of course of low  
22       persistence and had very low toxicity to fish, and  
23       other systems such as tadpoles, for instance, had very  
24       low sensitivity and were able to successfully undergo  
25       the same degree of development during exposure, so --

1           whether it be a test group or control group.

2                       The aminocarb and carbaryl, again, the  
3           anticipated exposure concentrations are below the  
4           effect concentrations, and particularly the sublethal  
5           effects as well, growth and reproduction.

6                       For fish there are some standard tests  
7           that are used, there are laboratory exercises to  
8           estimate what the effects would be in streams, and by  
9           comparison to the lab studies with reference to the  
10          exposure concentrations in the field, there's an  
11          opportunity to make a comparison because reproductive  
12          and growth assessments are lengthy and, therefore, they  
13          must be done in that way.

14                      Also in the field of course where these  
15          insecticides are applied directly through a controlled  
16          regime or in an overspray situation, the duration will  
17          be somewhat limited. In an overspray there is  
18          typically a spike occurrence which drops off very  
19          quickly, so the duration -- the opportunity for  
20          duration of exposure during sensitive life stages for  
21          the period of time required to produce the effect is  
22          limited and so, therefore, there's a need to rely  
23          heavily on lab exposures.

24                      They are typically a constant  
25          concentration and for a complete sensitive life stage,

1 so they tend to be overestimates of an effect or  
2 overestimates of an opportunity; that is, they are an  
3 exaggerated case to ensure that all life stages are  
4 exposed at a controlled rate.

5 So the vertebrate systems clearly appear  
6 to be protected again by the dilution factor and the  
7 concentrations for the carbamate or the fenitrothion  
8 are much below the sublethal effect concentrations and  
9 durations required.

10 Added to that, the opportunity for the  
11 chemical to degrade and hydrolize, which it does in  
12 natural water systems, so the degradation opportunities  
13 are extended in water for those compounds as well.

14 I think that covers the vertebrates and  
15 the invertebrates for the aquatic system.

16 Q. Dr. Schiefer, I understand you wish  
17 to make a comment with respect to the movement as a  
18 result of exposure of aquatic species?

19 DR. SCHIEFER: A. Well, from an  
20 ecosystem perspective, as Mr. Craig described,  
21 invertebrates -- the normal response mechanism is to  
22 detach and drift, really the only opportunity they have  
23 to go to lower concentrations.

24 The ecosystem effect of that, there have  
25 been quite a few studies that have noted fish feeding

1 behavioural response to that. Essentially a fish  
2 living in that stream is exposed to an increased drift  
3 of aquatic organisms and usually takes the opportunity  
4 to increase its feeding behaviour. That would normally  
5 be followed by a decline in drift during the period of  
6 recolonization.

7 Drift is an ongoing process in most  
8 streams. Invertebrates when they want to distribute  
9 themselves generally find it much easier to drift  
10 downstream than to try to actively swim upstream, they  
11 don't have much swim capability. So recolonization  
12 normally occurs from headwater tributaries that are  
13 unaffected, or because these are generally the larval  
14 forms of terrestrial insects, flies in particular, the  
15 adults usually will lay eggs, the larval stages will  
16 redevelop for some species within weeks, for others  
17 within months. So recolonization is generally a fairly  
18 rapid process either within the aquatic system or from  
19 the terrestrial system.

20 So the ecological effects at most trophic  
21 levels, including fish, is usually of short duration  
22 and may well be more of a displacement response than a  
23 long-term effect.

24 MR. CASSIDY: All right. I think I'm on  
25 safe ground if I ask Mr. Craig to move to Section 3.2.5

1 now, the Effect on Aquatic and Terrestrial Plants which  
2 can be found on page 78, Madam Chair and Mr. Martel.

3 MR. CRAIG: Madam Chair, as I mentioned  
4 before, the structure of the compound is critical to  
5 determining the effect on a non-target organism and  
6 this is an excellent illustration of incompatibility.  
7 Insecticides are not particularly effective on plants,  
8 they weren't designed to be effective or interact with  
9 metabolic systems in plants and the metabolic system in  
10 plants are not susceptible to insecticides.

11 So, consequently, we have found no  
12 evidence of significant impact on plants, whether they  
13 were terrestrial plants or aquatic plants, and that was  
14 the case for all of these compounds. So we would not  
15 anticipate that there would be significant or  
16 detrimental effects on plants regardless of their  
17 location.

18 MR. CASSIDY: If I could just have a  
19 minute, Madam Chair.

20 Thank you, Madam Chair. If we could move  
21 to page 79 of the witness statement, Exhibit 1222, and  
22 refer to the discussion on buffer zones, Section 3.2.6  
23 of Mr. Craig's evidence.

24 Q. And could you summarize that portion  
25 of your witness statement please, Mr. Craig?

1                   MR. CRAIG: A. Yes. Madam Chair, in our  
2                   discussion of or consideration of the effects of both  
3                   herbicides and insecticides and the application of  
4                   buffer zones, we've really taken into consideration the  
5                   buffer zones are around bodies of water, sensitive  
6                   aquatic areas, and all of the buffer zones that we've  
7                   mentioned we've identified those set out in Exhibit  
8                   803, and those zones have been identified for the  
9                   chemical pesticides of 120 metres for sensitive --  
10                  significant areas, 240 for sensitive areas and 240 for  
11                  human health or human habitation with no buffer zones  
12                  for the B.t.

13                 And these are, in our view, all going to  
14                 provide, as I mentioned, additional protection. From  
15                 my view we've been able to identify some reports of  
16                 some very minor aquatic effects and in some cases the  
17                 herbicides may induce some response for aquatic  
18                 vegetation, but it all recovers very quickly, certainly  
19                 the next year; and in the case of insecticides, the  
20                 protection of dilution, the natural protection of  
21                 dilution in flowing streams and large water bodies  
22                 precludes the need for an extensive buffer zone.

23                 It's my feeling that if these pesticides  
24                 can be kept at the edge of the surface water interface  
25                 with the land that would be quite adequate. So these

1 distances of 120 to 240 metres I think are of greater  
2 relevance and needed for other factors as Dr. Schiefer  
3 mentioned, and he identified the considerations of  
4 slope, canopy, water retention, temperature and erosion  
5 potential as governing the need for certain distance of  
6 buffer zones.

7 But for the insecticides, certainly those  
8 identified are adequate, they provide additional  
9 protection but it's not essential protection.

10 MR. CASSIDY: Madam Chair, the written  
11 evidence, page 79, refers to the buffer zones being set  
12 out in Exhibit 803. I can also advise that they are  
13 referred to in Exhibit 603 -- I'm sorry, 604C on page  
14 19 as a further reference for the Board, should you  
15 wish to find out more about those.

16 That document is entitled: The  
17 Environmental Effects of Pesticide Use for Timber  
18 Management in Ontario, one of the ESSA documents which  
19 you may recall.

20 Madam Chair, the next section I would  
21 rather -- I prefer to keep together. We're not going  
22 to finish it in three minutes, however, I would  
23 anticipate I would finish it in approximately 15 to 20  
24 minutes in the afternoon, but I ask that we deal with  
25 it in that fashion.

1 I would also ask any parties -- as a  
2 result, I anticipate I'll be finished within half an  
3 hour of our recommencement. I ask any parties who  
4 intend to cross-examine this afternoon to provide me  
5 with the exhibits that we might be able to retrieve  
6 over the course of the lunch hour for the witnesses and  
7 I would do that. So if they could, I'd appreciate it.

8 MADAM CHAIR: Thank you, Mr. Cassidy.

9 Mr. Castrilli, you will be following the  
10 completion of the evidence-in-chief?

11 MR. CASTRILLI: Yes, that's correct,  
12 Madam Chair.

13 I should just simply note that both  
14 myself and Mr. Lindgren will be cross-examining on this  
15 panel. We don't of course purport to duplicate each  
16 other. I will be dealing with Section 3 of the  
17 evidence and Mr. Lindgren will be dealing with Sections  
18 1 and 2. I will deviate from that with respect to just  
19 one item, but it will still be in relation to  
20 pesticides, so there will not be any duplication.

21 MADAM CHAIR: All right. Then what are  
22 the estimates of time you think it will take to  
23 complete your joint cross-examination?

24 MR. CASTRILLI: Myself approximately a  
25 day or less, for Mr. Lindgren approximately a half day

1 or less.

2 MADAM CHAIR: All right, thank you.

3 MR. CASSIDY: While we are on the topic  
4 of timing, Madam Chair, I can advise that I've had a  
5 discussion with Ms. Devaul who has very capably  
6 informed me of the other time estimates on this matter.

7 With Mr. Castrilli's estimates, we will  
8 probably get a good way to completing this panel this  
9 week; however, I'm advised that it may not be possible  
10 to get it all done, but there would be very little left  
11 to do after this week.

12 We, however, have a timing problem with  
13 respect to these witnesses with respect to next week.  
14 They have been asked by the Federal Ministry of the  
15 Environment to attend in Mexico next week on a project  
16 sponsored by the Federal Minister of the Environment  
17 and the Canadian International Development Agency with  
18 respect to the State of Vera Cruz, Mexico and,  
19 therefore, will be unavailable next week; however, what  
20 we intend to do is do the Panel 9B next week so there  
21 will be absolutely no loss of hearing time, and I'm  
22 advised that it is entirely possible to finish that  
23 whole panel next week.

24 Therefore, what I propose is if there is  
25 any, what I might call residual or left over

1 cross-examination to be done of this panel that we  
2 don't get through this week, that we would ask these  
3 panel members to come back and complete it just prior  
4 to the commencement of the planning panel during the  
5 week of June 18th.

6 But I just wanted to advise you of that  
7 possibility now and hopefully we can get as much done  
8 this week as possible so we can avoid that, but it is a  
9 possibility.

10 MADAM CHAIR: All right.

11 MR. CASSIDY: It will involve, however,  
12 absolutely no loss of hearing time.

13 MADAM CHAIR: Thank you, Mr. Cassidy.

14 MR. CASSIDY: Thank you.

15 MADAM CHAIR: We will break for lunch now  
16 and be back in an hour and a half.

17 MR. CASTRILLI: Madam Chairman, I might  
18 simply indicate on the record the exhibits I anticipate  
19 requiring for this afternoon so that they can be  
20 acquired.

21 MADAM CHAIR: Yes, please.

22 MR. CASSIDY: Thank you.

23 MR. CASTRILLI: Exhibits 729, 734, 748,  
24 1187, and 1188. And for the benefit of Mr. Cassidy who  
25 was not here last week, I filed complete versions of

1 Exhibit 729 and 748 and, given the shortness of time, I  
2 have extra copies available for both himself and the  
3 witnesses, if you would like to get them.

4 MR. CASSIDY: Thank you. Do those  
5 exhibit numbers also cover your cross-examination, Mr.  
6 Lindgren?

7 MR. LINDGREN: No, they don't. I will  
8 provide you with a list.

9 MR. CASSIDY: All right. Over the lunch  
10 hour?

11 MR. LINDGREN: To the extent I can.

12 MR. CASSIDY: All right. Thank you,  
13 Madam Chair.

14 MADAM CHAIR: Thank you.

15 ---Luncheon recess taken at 12:00 p.m.

16 ---On resuming at 1:30 p.m.

17 MADAM CHAIR: Please be seated.

18 Mr. Cassidy?

19 MR. CASSIDY: Good afternoon, Madam  
20 Chair, Mr. Martel, Mr. Huff.

21 Well, we are prepared to continue. I  
22 assume that Mr. Castrilli's absence will not prevent us  
23 from doing that, at least for the next 10 minutes, at  
24 which time I'll finish, and then we'll really start  
25 wondering where he is.

1 Are you able to assist us, Mr. Huff?

2 MR. HUFF: I cannot give you any  
3 assistance. I obviously did not go to the same place  
4 they did.

5 MADAM CHAIR: Perhaps we better stand  
6 down for a few minutes, Mr. Cassidy. I didn't see Mr.  
7 Castrilli out in the --

8 MR. HUFF: Neither did I.

9 MR. CASSIDY: I am in the Chairperson's  
10 hands.

11 MADAM CHAIR: Seeing as he's going to  
12 follow with cross-examination.

13 MR. CASSIDY: Okay.

14 MR. FREIDIN: It's an interesting phrase,  
15 stand down.

16 MADAM CHAIR: Yes, it is. Sit down.  
17 While we are waiting for Mr. Castrilli there are two  
18 matters: One, is that I understand we won't be hearing  
19 from Ms. Swenarchuk tomorrow evening, I think that's  
20 the case.

21 MR. CASSIDY: Do you know when, Madam  
22 Chair?

23 MADAM CHAIR: I think we will set a date  
24 for next week.

25 MR. CASSIDY: How does next Wednesday

1 sound?

2 MADAM CHAIR: We will do it Thursday  
3 night. What date is next Thursday?

4 MR. CASSIDY: June 14th. Flag Day.

5 MADAM CHAIR: You have a American  
6 calendar.

7 MR. CASSIDY: I have an American  
8 calendar.

9 MADAM CHAIR: June 14th.

10 MS. SEABORN: We're discussing an  
11 American witness, so perhaps it's appropriate.

12 MR. HUFF: My understanding is that there  
13 will be a letter--

14 MADAM CHAIR: Yes.

15 MR. HUFF: --sent over today which will  
16 give some information.

17 MADAM CHAIR: Yes. Ms. Devaul informed  
18 me that there would be a communication coming from Ms.  
19 Swenarchuk and the Board wants to talk to Mr. Turkstra  
20 before we hear those submissions, in any event. So it  
21 would be better for everyone if we had it next Thursday  
22 evening. That will be at five o'clock next Thursday.

23 And the second matter is, the Board is  
24 now looking far ahead into the future to schedule the  
25 cases following Forests for Tomorrow and we would like

1 to hear submissions from the parties on that scheduling  
2 before we recess for the summer.

3 We would like to hear submissions from  
4 the parties on June the 20th, which is a Wednesday  
5 evening, so we can start to do some long-range planning  
6 and I will have Ms. Devaul send out a notice to the  
7 parties about those two dates.

8 MS. SEABORN: Madam Chair, has the Board  
9 determined which days it will be sitting the last week  
10 of June? I believe the schedule just goes up until --  
11 or if the Board will be sitting that week?

12 MADAM CHAIR: Well, we would plan on  
13 sitting but we've got to see what happens with Panel  
14 10. We'll probably have a better idea by the end of  
15 next week about the progress of the Panels 9A and B.

16 MR. MARTEL: Industry doesn't want to  
17 start, you will recall, if they are going to split  
18 their last panel.

19 MADAM CHAIR: Yes. I don't think we  
20 can -- I would certainly plan that the Board will sit  
21 that week.

22 MR. CASSIDY: I would think by Wednesday  
23 the 20th you'll have a very good idea of where you  
24 stand. I mean, just on the assumption that we get a  
25 good portion of it done this week, we'll even have a

1 good idea by the end of this week, but I think  
2 definitely the 20th.

3 MADAM CHAIR: But certainly leave that  
4 week open don't schedule something else.

5 MS. SEABORN: It's just that Wednesday  
6 the 20th may be the day that we would actually start  
7 Panel 10, as I understand what Mr. Cassidy has said.

8 MR. CASSIDY: I see.

9 MS. SEABORN: If we move along on 9A,  
10 then we would finish that on the 19th and we would have  
11 already completed 9B, so we would be into Panel 10.

12 MR. CASSIDY: So it sounds like -- that's  
13 correct. Good point. Perhaps we should address it on  
14 Tuesday the 19th then.

15 MADAM CHAIR: Let's do that.

16 MR. CASSIDY: Thank you.

17 MADAM CHAIR: But leave that week open  
18 because if we can move along as we want --

19 MR. MARTEL: Well, by the 14th we'll have  
20 a better idea, that's next Thursday.

21 MR. CASSIDY: Then we will have a good  
22 idea as to whether or not 9B will go into the following  
23 week, which at this point we're not counting on that  
24 happening.

25 MR. MARTEL: No, and you'll know whether

1 9A is finished.

2 MR. CASSIDY: Yes. We will know that by  
3 the end of this week. We will know so much --

4 MADAM CHAIR: We have tomorrow, Mr.  
5 Cassidy.

6 MR. CASSIDY: All right. There is just  
7 one matter I would like to advise the Board of, one of  
8 the witnesses has asked to look at a transcript from  
9 last week's evidence, last Thursday's which is Volume  
10 209. That's in fact not prepared yet, and I'm advised  
11 by the reporter it will not be available until tomorrow  
12 night at the end of the day.

13 The witness will be in cross-examination  
14 by that time. I'm simply advising the Board, as I have  
15 advised Mr. Castrilli, that I intend to have that  
16 provided to the witness - I understand he has no  
17 objection - and what I intend to do, to avoid any  
18 difficulties whatsoever, is ask the reporter to give it  
19 to the witness directly at the end of the day tomorrow.  
20 So I just wanted to advise the Board of that situation.

21 MADAM CHAIR: Thank you, Mr. Cassidy.

22 MR. CASSIDY: We are now in a position to  
23 recommence as Mr. Castrilli has joined us. And I just  
24 want to move to complete Mr. Craig's evidence, and the  
25 Board may wish to -- could I just have a minute.

1                   If I could ask the Board to turn to page  
2                   81 of Exhibit 1222 and the conclusions on the Effects  
3                   of Pesticide Use are referred to therein.

4                   Q.   And I understand, Mr. Craig, that you  
5                   wish to discuss those conclusions with the Board with  
6                   respect to both herbicides and insecticides and  
7                   complete your evidence in that fashion?

8                   MR. CRAIG:   A.   Madam Chair, in  
9                   conclusion I would like to identify that it's important  
10                  to reflect on those earlier principles that I  
11                  identified earlier and; that is, that the exposure  
12                  concentrations compared to the effect concentrations,  
13                  whether they be acute, lethal or long-term sublethal,  
14                  are absolutely paramount.   Studies that are reported  
15                  quite often will identify the effect concentrations and  
16                  it's important to put that in terms of context with  
17                  what is actually going to be in the field after an  
18                  approved application rate.

19                  So my evaluation and conclusions are  
20                  based on that condition, that the herbicide will be  
21                  applied in an approved manner, and those concentrations  
22                  are selected so that they will have the appropriate  
23                  effect on target organisms and will provide a level of  
24                  level that is below effect concentrations for  
25                  non-target organisms, and that applies for vegetative

1 plants and for non-target animals for herbicides and  
2 pesticides -- insecticide.

3 The other important factors are that  
4 given that those exposure levels are controlled the  
5 insecticides and pesticides are degradable, under  
6 certain environmental conditions they are readily  
7 degradable, and they also are not the type of compound  
8 that accumulates to a high concentration in organism  
9 body tissues, so that they don't represent a food chain  
10 accumulation type of situation that is a concern for  
11 other pesticides.

12 In areas that we've identified there to  
13 be some stress, particularly in the terrestrial  
14 environment with regard to invertebrates and some  
15 slight stress in aquatic systems, we have identified  
16 from various studies that there is an opportunity for  
17 recovery, primarily because these chemicals do degrade  
18 and are not persistent.

19 The insects that are of particular  
20 concern are primarily pollinators from the studies that  
21 we have reviewed, and so those seem to be the groups of  
22 insects that would be at greatest risk, non-target  
23 species.

24 MR. CASSIDY: That concludes this panel's  
25 evidence, Madam Chair.

1 MADAM CHAIR: All right. Thank you very  
2 much, Mr. Cassidy.

3 Mr. Castrilli?

4 MR. CASTRILLI: Thank you, Madam Chair.  
5 Could we make the same arrangement as last time.  
6 Perhaps Mr. Cassidy and I can simply switch places so I  
7 can move all my material.

8 MADAM CHAIR: That's fine.

9 MR. CASSIDY: I prefer to sit at this  
10 table, Madam Chair, unless it's a difficulty for  
11 anyone.

12 MR. CASTRILLI: No, no, I'm sorry, I  
13 didn't mean to suggest you had to come all the way back  
14 here.

15 MR. CASSIDY: Thank you.

16 ---Discussion off the record

17 MR. CASTRILLI: Madam Chair, I would like  
18 to begin by filing the interrogatories we asked this  
19 panel.

20 MADAM CHAIR: That will be Exhibit 1232.

21 MR. HUFF: (handed)

22 ---EXHIBIT NO. 1232: Forests for Tomorrow  
23 Interrogatory Question Nos. 1-16  
re OFIA/OLMA Panel 9A.

24 MR. CASTRILLI: Panel members, do you  
25 have copies of the interrogatory answers, this is for

1 Forests for Tomorrow?

2 MADAM CHAIR: Those are Interrogatory  
3 Nos. 1 through 16, Mr. Castrilli?

4 MR. CASTRILLI: Yes, that's correct,  
5 Madam Chair. And that was Exhibit...?

6 MADAM CHAIR: 1232.

7 CROSS-EXAMINATION BY MR. CASTRILLI:

8 Q. Gentlemen, if I might direct your  
9 attention to page 2 of Exhibit 1232, and this is a  
10 question I asked you in relation to paragraph 3 of your  
11 evidence which is Exhibit 1222, it's page 20. We asked  
12 you:

13 "Under what circumstances would a stand  
14 be treated with 2,4-D or glyphosate more  
15 than twice during a rotation?"

16 And the answer you provided was:

17 "The answer to the question is currently  
18 being researched and will be provided as  
19 soon as possible."

20 Do you have any further information to  
21 advise us with respect to that answer at this point?

22 MR. CRAIG: A. Madam Chair, I'm sorry,  
23 we still do not have. We focused our attention on the  
24 effects component. We came across this mention of  
25 possible multiple use and not being familiar with

1 forest management practices, at this stage we have not  
2 been able to identify those circumstances.

3 MADAM CHAIR: Is this one area, Mr.  
4 Cassidy, where Thursday's transcripts will offer some  
5 clarification, or some of the evidence from last week.

6 MR. CASSIDY: I'm sorry, Madam Chair, I'm  
7 not sure that -- I have not had an opportunity to speak  
8 to the witness about that.

9 I can advise that as soon as this answer  
10 is completed from this witness' perspective we can get  
11 it to him, we'll make every attempt to get it to Mr.  
12 Castrilli, and if it is a matter that has to be  
13 cross-examined on, there are -- if it's a matter that  
14 he cross-examined forestry witnesses on, there will be  
15 foresters on the next panel and we'll try and get it to  
16 him in time to cross-examine the forester witnesses,  
17 so...

18 MADAM CHAIR: Will you be satisfied with  
19 a written response to this, Mr. Castrilli?

20 MR. CASTRILLI: Madam Chair, I'd be  
21 content with the undertaking to provide the informatin  
22 when it's available and when we get it, we'll see what  
23 may arise from it. Thank you.

24 Q. Now, continuing with Exhibit 1232, I  
25 direct your attention to page 6 and this is with

1           respect to your evidence which is found at page 28 of  
2           Exhibit 1222 regarding the herbicide picloram.

3                       Now, I will just read the question and  
4           the answer into the record. Under Picloram, paragraph  
5           2 states that:

6                       "Due to the stability of picloram in  
7           plant growth tissue it is expected that  
8           most of the herbicide will remain within  
9           the treated stems."

10                      And the question we asked was:

11                      "If most but not all of the herbicide  
12           remains within treated stems, what is the  
13           most likely fate of the remainder of the  
14           herbicide?"

15                      And the answer you provided was:

16                      "Small amounts may end up in the soil  
17           because of loss through the root system  
18           but there is no evidence of this  
19           occurring in treated trees in northern  
20           Ontario."

21                      And I just wanted to ask you, Dr. Craig,  
22           do you have some references that you can provide us  
23           with respect to the last part of your answer which is  
24           the part that says:

25                      "...there is no evidence of this

1 occurring in treated trees in northern  
2 Ontario."

3 And I would be pleased to take that as an  
4 undertaking as well if you don't have the information  
5 readily available.

6 MR. CRAIG: A. Madam Chair, we could not  
7 locate any information to indicate that there were  
8 residuals in northern Ontario. At this stage we don't  
9 have a specific reference in mind.

10 MADAM CHAIR: Mr. Craig, have there been  
11 very many -- have there been any studies done on soil  
12 sampling in sprayed areas?

13 MR. CRAIG: Yes. Well, for picloram  
14 there would be some studies that would focus on  
15 degradation in general. What we would look at here is  
16 that once the compound ended up in soil, then it would  
17 be open to all of the natural degradation processes in  
18 a soil environment or water environment, whatever.

19 So we have looked at that sort of general  
20 set of conditions. That's our consideration in this  
21 particular response.

22 MR. CASTRILLI: Q. Dr. Craig, just so  
23 I'm clear on your answer to that question, have there  
24 been studies which have focused their attention  
25 directly on the issue of what I call exudation of

1 picloram through the root stems which concluded, as you  
2 do in your answer, the first part of your answer?

3 MR. CRAIG: A. I can't recall  
4 specifically a study at the moment.

5 MR. CASSIDY: I just thought I could  
6 indicate for the record, just for clarification  
7 purposes, it's Mr. Craig.

8 MR. CASTRILLI: Oh, I'm sorry. Thank  
9 you. Mr. Cassidy will be pleased to know in the  
10 previous panel I withdrew somebody's Ph.D., I think I  
11 just gave it to Mr. Craig.

12 Q. Fine, let's move on. Could I refer  
13 you to page 39 of your evidence, Mr. Craig. This is  
14 under the heading of 2,4-D and in the first sentence  
15 you indicate that:

16 "Significant direct toxic effects on fish  
17 are exceedingly unlikely to occur as a  
18 result of 2,4-D applications in timber  
19 management."

20 It's in paragraph 3 on that page. And  
21 you also note that:

22 "Of the various forms of 2,4-D  
23 commercially available, primarily ester  
24 formulations are used for timber  
25 management in Ontario."

1 Can you advise me, Mr. Craig, whether  
2 because of fish toxicity concerns the ester formulation  
3 is generally not used in British Columbia in broadcast  
4 treatments?

5 MR. CRAIG: A. I can't identify the  
6 rationale for using that particular formulation for  
7 broadcasting. I could venture some reasons, but they  
8 would be outside of the area of toxicology.

9 Q. Do you know whether B.C. uses 2,4-D  
10 ester or not?

11 A. I'm not --

12 Q. In timber management.

13 A. I'm not terribly familiar what  
14 formulations are used in which provinces in that  
15 regard. My focus has been on the chemical and the  
16 effect on the various target and non-target organisms,  
17 Mr. Castrilli.

18 Q. That is fine, thank you. I refer you  
19 to page 37 of your evidence. This is under the heading  
20 Direct Toxic Effects on Fish, and you state in the  
21 first paragraph:

22 "The potential for fish to be directly  
23 affected by herbicide application can  
24 arise through overspray..." I'll just  
25 number these: overspraying is the first item, and the

1 second would be.

2 "...or drift of sprayed herbicides."

3 Mr. Craig, or if Dr. Schiefer can assist  
4 I would be pleased to have his answer as well. Would  
5 you agree that fish may also be directly affected by  
6 herbicide application as a result of runoff?

7 A. That's a potential route for  
8 exposure, yes.

9 Q. Would you also agree that fish may be  
10 directly affected by erosion of contaminated soil that  
11 gets into bodies of water such as streams, lakes and  
12 rivers?

13 A. I would agree that there is a  
14 potential for exposure, but I am not so certain there  
15 would be a potential for effect, primarily on the  
16 principles as I have mentioned earlier, Madam Chair,  
17 dilution and degradation.

18 Q. And would you agree that fish may be  
19 directly affected by water running through ephemeral  
20 channels that have been sprayed?

21 A. Mr. Castrilli, such as -- what do you  
22 mean, ephemeral?

23 Q. Transient streams that might last  
24 just a day, where the bed has been sprayed and there's  
25 a subsequent flow of water through it?

1                   A. Yes. Madam Chair, again, I would  
2 support the theory of exposure, but from our review I  
3 couldn't support the suggestion of effect.

4                   Q. And so if I understand your evidence,  
5 Mr. Craig, fish may be exposed to water running through  
6 ephemeral streams, and the question of whether they may  
7 be directly affected would depend upon concentration  
8 and related factors; is your testimony?

9                   A. That's correct, Mr. Castrilli.

10                  Q. Thank you. Continuing at page 37 we  
11 are now under the heading of Glyphosate. You refer  
12 there to a number of published proceedings of the  
13 Carnation Creek Herbicide Workshop. Can you advise the  
14 Board, Mr. Craig, are the papers coming out of these  
15 workshops peer reviewed?

16                  A. I would have to refer back to the  
17 documents, I think -- Mr. Castrilli, I'm uncertain. I  
18 would have to check the original document. Sometimes  
19 document -- reports can be submitted as part of a large  
20 study and may individually be submitted for peer  
21 review. I'm just unclear at this stage. I would have  
22 to check.

23                  Q. Perhaps you can, in particular,  
24 direct your attention to the Holtby and Baillie  
25 reference at the bottom of page 37 when you're making

1 your inquiries with respect to that matter.

2 At the bottom of page 37 and over on to  
3 page 38, where you are referring to the Holtby and  
4 Baillie report suggests that:

5 "The Roundup surfactant may have been  
6 responsible for inducing temporary stress  
7 in caged and resident coho fry in the  
8 tributary during the first two weeks after  
9 spraying."

10 And then you go on to note:

11 "However, these effects were observed  
12 under direct overspray conditions and  
13 were short in duration. The authors  
14 state that the temporary stress which was  
15 observed among aquatic organisms  
16 justified precautionary procedures such  
17 as use of buffer zones for Roundup."

18 And just going on to the end of that  
19 paragraph:

20 "They concluded that these precautions  
21 would provide adequate protection against  
22 surfactant effects in non-target  
23 waterways."

24 So, if I understand your testimony at  
25 those two pages, Mr. Craig, would it be fair to say

1           that, in your view, buffer zones are necessary in order  
2           to avoid extreme stress on fish from exposure to  
3           Roundup or Vision?

4                   A.   I would suggest that the direct  
5           overspray is a worse case situation.   Where sprays are  
6           retained on the terrestrial area, again, all of the  
7           factors I've mentioned that will minimize concentration  
8           and exposure concentration will come into play.   So as  
9           I also indicated, any amount of buffer would be  
10          advantageous and provide additional protection not  
11          already provided in the natural dilution process.

12                   Q.   The next paragraph on page 38 you  
13          indicate that:

14                           "Buffer zones around waterways especially  
15                           near fish spawning areas are necessary in  
16                           order to protect fish against direct  
17                           toxic effects from Vision."

18                           Is that right?   Is that still your  
19          testimony; still your position?

20                   A.   I'm sorry, which paragraph is that,  
21          Mr. Castrilli?

22                   Q.   I am looking at paragraph 2 on page  
23          38.

24                   A.   Yes.   Where there are fish spawning  
25          areas, that's correct, buffer zones will provide that

1 additional protection.

2 Q. I am looking at the bottom of page  
3 38. I understand your testimony to be that:

4 "...glyphosate was relatively non-toxic  
5 to flagfish at least up to 30...", is  
6 that micrograms per litre?

7 A. Milligrams per litre.

8 Q. "...milligrams per litre." And you  
9 refer there to a study by Holdway and Dixon.

10 And at bottom of page -- sorry, over on  
11 to page 39 you indicate that:

12 "The available data indicates that no  
13 significant avoidance behaviour by  
14 rainbow trout was noted with respect to  
15 glyphosate."

16 A. Yes.

17 Q. Just focusing on the Holdway  
18 article -- Holdway and Dixon article for the moment,  
19 was that study a study of glyphosate the active  
20 ingredient only, or was it a study in relation to the  
21 the fully formulated product which would be either  
22 Vision or Roundup?

23 A. That would be expressed as glyphosate  
24 as opposed to the formulation.

25 Q. So what they studied was the active

1 ingredient only; is that correct?

2 A. It would be expressed as that.

3 Q. When you say expressed as that, what  
4 do you mean?

5 A. Well, they would have -- again, I  
6 would have to refer to the original article, but if  
7 they were to use a formulation which would contain  
8 glyphosate and solvent, for instance, and carriers,  
9 they would express the effect in terms of the active  
10 ingredient; that is, there would be a small percentage  
11 of the total product that would be glyphosate and the  
12 balance of the liquid would be solvent, an aqueous  
13 solvent type of base, so it would be expressed as  
14 glyphosate.

15 Q. Do you know whether in this  
16 particular study by Holdway and Dixon that what was  
17 tested was just glyphosate?

18 A. I would have to refer to the original  
19 article to confirm that.

20 Q. All right, thank you.

21 MR. CASSIDY: Would you want an  
22 undertaking they do that?

23 MR. CASTRILLI: I think I will probably  
24 provide it to him later and we can sort it out that  
25 way.

1 Q. I turn you to page 25, Mr. Craig.  
2 Under the heading for 2,4-D. Do you report in your  
3 evidence on 2,4-D residues in other foods found in the  
4 wild in the area of the undertaking besides  
5 blueberries?

6 A. No, I have referred only to the  
7 blueberry example.

8 Q. Is there any reason to believe that  
9 blueberries are the only food in the forest that can  
10 have potential residues of 2,4-D after a spray event?

11 A. No, not to my knowledge.

12 Q. Have there been 2,4-D residue studies  
13 on other berries such as bunch berries in the area of  
14 the undertaking, to your knowledge?

15 A. Not to my knowledge. I'm not  
16 immediately aware of that.

17 Q. Did you conduct any actual studies in  
18 preparation for your evidence here today with respect  
19 to other food types in the area of the undertaking and  
20 possible 2,4-D residues?

21 A. No, I have not.

22 Q. Are bunch berries found in the area  
23 of the undertaking?

24 A. I couldn't tell you offhand.

25 Q. Dr. Eedy, can you assist us?

1 DR. EEDY: A. Well, I know personally I  
2 found in Labrador and in the Northwest Territories. I  
3 haven't personally found them in the area of the  
4 undertaking, but I believe that with that distribution  
5 they probably could be.

6 MADAM CHAIR: Excuse me, are we talking  
7 about bunch berries?

8 MR. CASTRILLI: Yes.

9 DR. EEDY: Yes.

10 MADAM CHAIR: Can someone tell us what  
11 bunch berries are, or if you can't, Mr. Castrilli, is  
12 there someone who has some familiarity with bunch  
13 berries?

14 MR. CASTRILLI: I don't think I would  
15 want to hazard a description of bunch berries. I can't  
16 provide you with evidence in any event.

17 MADAM CHAIR: Mr. Huff?

18 MR. HUFF: They are berries that can be  
19 used by some people who do eat them and they are also  
20 used as food for some wildlife species. If you want, I  
21 can bring you in a one-page document on that tomorrow.

22 MADAM CHAIR: I would appreciate that.

23 MR. HUFF: You're welcome.

24 MR. CASTRILLI: Q. Dr. Eedy -- you're  
25 the ones under oath right now. Do wildlife eat bunch

1 berries.

2 DR. EEDY: A. They certainly do, yes.

3 Q. Thank you. Mr. Craig, do you report  
4 in your evidence, which would be Exhibit 1222, on 2,4-D  
5 residues in fungi in the area of the undertaking, fungi  
6 in the area of the undertaking?

7 MR. CRAIG: I don't believe so. I don't  
8 believe I discussed that.

9 Q. And I presume, therefore, you didn't  
10 prepare any actual studies on 2,4-D residues in fungi  
11 for this hearing?

12 A. No, sir.

13 Q. Are fungi found in the area of the  
14 undertaking, Mr. Craig?

15 A. I'm sure they are. What little I  
16 know about fungi, they take on many different forms.  
17 Fungi are, to my understanding, ubiquitous in the  
18 environment anyway.

19 Q. Sorry, had you completed your answer?

20 A. Yes, I am, thank you.

21 Q. All right. Dr. Eedy, do wildlife eat  
22 fungi?

23 DR. EEDY: A. Certain types.

24 Q. Is that certain types of wildlife or  
25 certain types of fungi?

1 A. Both.

2 Q. All right.

3 A. Certain types of wildlife will eat  
4 certain types of fungi.

5 MADAM CHAIR: Do we have truffles in  
6 northern Ontario?

7 DR. EEDY: I don't think so, but I  
8 know -- for instance, my dog loves mushrooms and we  
9 have a certain kind of mushroom in our backyard which  
10 I'm always trying to beat him to because me beat him or  
11 else. If he finds them he eats them; if we find them  
12 first, we eat them.

13 MR. CASSIDY: There's no magic in any of  
14 those?

15 DR. EEDY: no.

16 MR. CASTRILLI: Madam Chair, I'm sure  
17 we're all getting very hungry from this discussion.

18 MR. CASSIDY: Over fungi.

19 MR. CASTRILLI: Q. Let me cover off a  
20 number of items all at once, Mr. Craig, just to shorten  
21 this up. Grass, forage, seeds and insects, are these  
22 found in the area of the undertaking?

23 MR. CRAIG: A. I would expect so, yes.

24 Q. Dr. Eedy, do wildlife eat these  
25 various items?

1 DR. EEDY: A. Yes.

2 Q. Your answer was...?

3 A. Yes.

4 Q. Mr. Craig, did you do any studies on  
5 actual 2,4-D residues in grass, forage, seeds or  
6 insects for this hearing -- your appearance before this  
7 Board today?

8 MR. CRAIG: A. Not specifically all of  
9 these items, no. I think our blueberry example would  
10 cover, I think, some of the forage and seed components.  
11 That would be the limit of the example, I think.

12 Q. Well, you have reported on one or  
13 more blueberry studies.

14 A. Yeah, blueberries are seeds.

15 Q. Oh, I see.

16 A. They're fruits.

17 Q. So to that extent you've reported on  
18 seeds, but there are other types of seeds?

19 A. I'm sure.

20 Q. Thank you. And just so I'm clear, do  
21 we have any evidence from you on 2,4-D residues in any  
22 of those items I just mentioned grass, forage, seeds,  
23 insects?

24 A. Not outside of the examples we have  
25 cited.

1 Q. All right. Thank you. Can I refer  
2 you, Mr. Craig, to page 22 of your evidence.

3 We're looking at the first paragraph  
4 under the heading Environmental Persistence, and we are  
5 looking at the second sentence in that paragraph that  
6 begins, "In other words..."

7 I will just read the entirety of the  
8 sentence into the record:

9 "In other words, a compound may be  
10 persistent but will only be  
11 environmentally hazardous if the exposure  
12 concentrations or doses are present at  
13 levels above the respective toxic  
14 threshold concentrations for the  
15 applicable compound...", or I presume you  
16 mean compounds.

17 Now, I wasn't clear about that statement,  
18 Mr. Craig. I presume when you begin the sentence by  
19 using the word a compound, you are referring to one  
20 chemical; is that right?

21 A. Yes, correct.

22 Q. And that sentence, therefore, is  
23 directing itself to an assessment of one chemical at a  
24 time?

25 A. Yes.

1 Q. Does your analysis take into account  
2 additive or synergistic effects of other chemicals in  
3 the environment at the same time?

4 A. Not specifically. We have considered  
5 these pesticides individually.

6 Q. Mr. Craig - and perhaps this question  
7 can be directed to both Dr. Eedy and Mr. Craig at the  
8 same time - can a compound become environmentally  
9 hazardous to wildlife in conjunction with wildlife  
10 exposure to cold or hunger?

11 A. Sorry, could you repeat that again,  
12 please?

13 Q. Can a compound become environmentally  
14 hazardous to wildlife in conjunction with wildlife  
15 exposure to cold or hunger?

16 A. Well, from my experience in toxicity  
17 testing other stresses can increase the effect of a  
18 particular toxicant for instance, yes, that's true.  
19 There tends to be a slight increase in the toxicity, so  
20 it certainly will have a modifying effect.

21 I would think that would be true of most  
22 organisms exposed to marginally toxic levels of a  
23 chemical.

24 Q. Mr. Craig, at page 23 under the  
25 discussion on bioconcentration, we're looking at the

1 second full paragraph - I'm sorry, that is Exhibit  
2 1222 - you refer there to bioconcentration factors  
3 which you call BCFs and you state in the sentence  
4 beginning, "However...", Which is about two thirds of  
5 the way down that paragraph:

6 "However, only when the BCF values exceed  
7 a level of about 100 are compounds  
8 considered to be a potential threat to  
9 the organism or the ecosystem."

10 Mr. Craig, does that conclusion depend on  
11 the toxicity of the compound?

12 A. Mr. Castrilli, I'm not sure  
13 exactly -- let me answer that if the -- first of all,  
14 this is a reference to a summary, a conclusion that a  
15 group of experts arrived at and what they indicated is  
16 that if the BCF is greater than a hundred then there is  
17 a greater opportunity for the compound to travel up the  
18 food chain, there is less opportunity for excretion at  
19 each level and, therefore, the bioaccumulation  
20 component can have an effect.

21 So that at the highest food chain level  
22 there is an opportunity for the organism to have a  
23 higher concentration than was present in the  
24 environment at the ground level.

25 Now, as to the toxicity of that compound,

1 I think that that magnification function can occur  
2 regardless of the toxicity. It's a characteristic of  
3 the compound and the lipid solubility of that compound,  
4 it has nothing to do with the toxicity of the compound.

5 Q. I see where you were struggling with  
6 my question. I'm sorry it wasn't as clear as it could  
7 have been. Let me put the question to you this way:  
8 Are there some compounds that are toxic at 0 BCF?

9 A. Oh yes.

10 Q. Thank you. Mr. Craig, we are now  
11 going to go directly now to page 25 of your evidence,  
12 we're looking at paragraph 4. It would be the second  
13 paragraph under 2,4-D.

14 You refer to a recent study in a  
15 northeastern Ontario lake that indicates that 2,4-D  
16 directly applied as a spray to surface waters had a  
17 half-life of 8 days, and you refer to the study.

18 And I understand from your testimony that  
19 2,4-D is a non-persistent compound in water; was that  
20 your testimony?

21 A. Yes.

22 Q. And as I understand it, with a  
23 half-life of days to several weeks?

24 A. Yes.

25 Q. Mr. Craig, is it also true that

1 studies indicate that, or other studies indicate that  
2 2,4-D can remain in still water such as ponds. Lakes  
3 and reservoirs for months?

4 A. I am not certain of that -- of those  
5 references. Perhaps you could direct me to what you  
6 specifically had in mind.

7 Q. Do you have Exhibit 748 in front of  
8 you?

9 MR. CASTRILLI: Madam Chair, Exhibit 748  
10 is the Guidance for the Reregistration of Pesticide  
11 Products Containing 2,4-D as the Active Ingredient.

12 MADAM CHAIR: No, the Board doesn't have  
13 it, Mr. Castrilli.

14 MR. CASTRILLI: This is the cover for it.

15 MADAM CHAIR: Sorry, it could be in  
16 Thunder Bay or somewhere.

17 ---Discussion off the record

18 MR. CASSIDY: If I can just have your  
19 indulgence, Madam Chair. We have an excerpt from the  
20 full version which we can rely on, so....

21 MR. CASTRILLI: Is this is page 18?

22 (handed)

23 MADAM CHAIR: Thank you.

24 I thought we had it last week, we will check at the  
25 break and see...

1 MR. CASTRILLI: Thank you.

2 MADAM CHAIR: Is that page 18, Mr.

3 Castrilli?

4 MR. CASTRILLI: Page 18, paragraph 2.

5 Actually, Madam Chair, it's referred to in two places  
6 on that page. The first full paragraph and the second  
7 full paragraph. I will refer to both sentences. The  
8 Agency is here referring to -- in paragraph 2:

9 "These data indicate that residues  
10 dissipate rapidly in moving water. In  
11 still waters such as ponds, lakes and  
12 reservoirs residues of 2,4-D per se were  
13 detected as much as six months after  
14 application."

15 And then moving down to the third  
16 paragraph on the page, the sentence that begins:

17 "Conversely, in ponds, lakes and  
18 reservoirs residues of 2,4-D per se were  
19 detected in water as much as six months  
20 after treatment."

21 Q. Were you familiar with that body of  
22 literature, Mr. Craig?

23 MR. CRAIG: A. I have reviewed various  
24 of these, so...

25 Q. I'm sorry, your answer is...?

1 A. I have seen it before.

2 Q. All right. Thank you.

3 A. But --

4 Q. Would it be fair to say, Mr. Craig -  
5 I think I just gave you your Ph.D. again, sorry - would  
6 it be fair to say that six months for a residue to  
7 remain in water would make 2,4-D -- I'm sorry, in  
8 aquatic environment, would make 2,4-D a persistent  
9 compound in water, in the types of water we're  
10 discussing at page 18 of Exhibit 748?

11 A. According to the definition I used  
12 earlier in my testimony, Madam Chair, indeed that would  
13 qualify. The perspective to be aware of though is that  
14 in order for a compound to be truly persistent it must  
15 be sufficiently stable structurally so that given the  
16 opportunities of degradation it would not degrade at a  
17 rate that would allow a half-life of 8 weeks, for  
18 instance, which is what we used for the IJC definition.

19 There is no doubt that compounds such as  
20 2,4-D when applied to a lake or pond situation would be  
21 associated with particulate phase material or sediment,  
22 could indeed be in a rather innocuous environment and,  
23 therefore, would not have the advantage of degradation  
24 that would be available to a highly nutritive aerobic  
25 degradation process.

1                   MADAM CHAIR: Mm-hmm. If it were in the  
2 sediment though, you wouldn't expect to detect it in  
3 water?

4                   MR. CRAIG: Typically that's true.

5                   MADAM CHAIR: And we've got to assume  
6 that these are very trace amounts. I mean, between  
7 being hydrolized and diluted the amounts must be barely  
8 detectable?

9                   MR. CRAIG: Well, that's true too. In  
10 the context of this sentence I would anticipate that  
11 the 2,4-D would be above the level of detection for  
12 that method of analysis.

13                  MADAM CHAIR: Is 2,4-D ubiquitous in  
14 southern Ontario or near agricultural areas?

15                  MR. CRAIG: I'm not certain offhand. I  
16 wouldn't be surprised if it could be. I think --

17                  DR. EEDY: I think, if I could add to  
18 that answer, that was one question in my mind. The  
19 definition refers to half-life, it doesn't refer to  
20 detectable. The half-life means that 50 per cent of it  
21 disappears within each unit amount of time.

22                  So if there's a fairly large amount at  
23 time zero, there could still be something detectable  
24 after a considerable period of time and still not meet  
25 the definition of persistence that was given.

1 MR. CASTRILLI: Q. Now, Mr. Craig, I  
2 wonder if you could help me for a moment. I was going  
3 to refer to Exhibit 1230 but, as I recall, that's one  
4 of your diagrams. Perhaps you could flip that flip  
5 chart.

6 MR. CASSIDY: Dr. Eedy, could you just  
7 flip that 1229 over.

8 MR. CASTRILLI: Q. All right. This is  
9 the hand-drawn diagram illustrating the structure  
10 toxicity relationship, that's Exhibit 1230.

11 Mr. Craig, I want to ask you: What is  
12 the mode of toxicity of let's just take 2,4-D, as an  
13 example, to terrestrial animals?

14 MR. CRAIG: A. It's difficult for me to  
15 say. Quite often what will develop in non-target  
16 organisms is very non-descript and non-specific types  
17 of responses. Because the chemical is not well  
18 received by the organism there is always an opportunity  
19 for a number of systems, metabolic systems to be  
20 affected at very high dose levels in the non-target  
21 organism, so quite often when modes of toxic action are  
22 identified in non-target species they tend to be a  
23 number rather than just a single type of response.

24 In the case of 2,4-D I'm not entirely  
25 sure all of the systems that would be inhibited or

1       impaired, but I would anticipate that they would occur  
2       at fairly high concentrations, that is much higher than  
3       the organism would normally experience.

4                   Q.   Let me -- I was interested in you  
5       phrase, the chemical is not well received by the  
6       organism.   How do animals die from exposure to 2,4-D?

7                   A.   Well, are you speaking of mammals  
8       perhaps?

9                   Q.   Terrestrial animals--

10                  A.   Terrestrial.

11                  Q.   --as you define it in your evidence,  
12       and perhaps you can name one if you're going to  
13       describe particular characteristics.

14                  A.   I don't believe I can outline  
15       specifically for you all of the routes of pathways that  
16       would be affected.   I'm sorry, I can't take that one  
17       too far.

18                  Q.   All right.

19                  MADAM CHAIR:   Mr. Craig, in the  
20       literature is there very much evidence of mortality  
21       from exposure to 2,4-D in animal populations?

22                  MR. CRAIG:   Well, Madam Chair, in  
23       experiments where these have been conducted and  
24       certainly there are LC50s and LD50 concentrations cited  
25       in these documents.

1                   MADAM CHAIR: Oh, I didn't know we were  
2 talking about the laboratory work.

3                   MR. CRAIG: It could be a mouse or --  
4 let's say a mouse or a rat, there are a number of these  
5 toxic levels. The exercise is conducted is to feed or  
6 force the animal to take in the chemical.

7                   Typically the kinds of modes of toxic  
8 action of these kinds of compounds would be disruption  
9 of liver enzyme function, so that the animal would no  
10 longer be able to go through the normal metabolic  
11 processes of breaking down nutrients and utilizing  
12 them. Typically also kidney function is interrupted  
13 and there are a great many enzyme systems that work  
14 there, and essentially what happens the animal suffers  
15 from kidney failure, but -- and those would be what I  
16 would anticipate as being the modes of action, but they  
17 would be very non-specific, they would be pervasive --  
18 pervasive and would result in general metabolic  
19 dysfunction. That is what I would expect. But it's  
20 the result of essentially force feeding or injection or  
21 gastric lavage of these compounds until the population  
22 of animals treated die.

23                   So it is important to establish these  
24 kinds of levels and these kinds of effects in order to  
25 determine the relative toxicity of a compound to a

1 group of animals.

2 MADAM CHAIR: I'm sorry, I think I  
3 misunderstood Mr. Castrilli's question. I thought he  
4 was talking about exposure of animals in the wild to--

5 MR. CRAIG: Yes.

6 MADAM CHAIR: --2,4-D spraying.

7 MR. CASTRILLI: Yes.

8 MR. CRAIG: Yes, I understood the  
9 question to be fairly broad.

10 MR. CASTRILLI: Well, Madam Chair, I'm  
11 content to have Mr. Craig's answer both with respect to  
12 the experimental laboratory situation as well as the  
13 wild, if his answer varies depending on which site we  
14 are talking about.

15 MR. CRAIG: Well, it would -- no, the  
16 mode of action would be the same in a laboratory  
17 situation or a field situation, if the exposure  
18 concentration were high enough.

19 In the lab it's forced to be high enough;  
20 in the field, based on the information that we have and  
21 based on laboratory toxicity values, we would  
22 anticipate that it would be extremely difficult to  
23 arrive at those exposure concentrations -- pardon me,  
24 those dosages in wild animals.

25 MR. CASTRILLI: Q. Mr. Craig, just

1 referring you back then to Exhibit 1230 which is an  
2 illustration of structure toxicity relationships, at  
3 the bottom half of that diagram on the left-hand side  
4 we're looking at the chemical, on the right-hand side  
5 we're looking at the receptor, and you describe in this  
6 case trying to fit a square chemical in a round  
7 receptor as a poor fit, if I get the gist of the  
8 diagram.

9 And lower half of that diagram is with  
10 respect to non-target organisms; is that right?

11 MR. CRAIG: A. That's correct.

12 Q. And would it be fair to say,  
13 therefore, your description of how 2,4-D might disrupt  
14 an animal's metabolic process such as liver and kidney  
15 et cetera, that we would be making about more than one  
16 poor fit?

17 A. Yes, in that one might look at a  
18 number of different types of receptors that would be  
19 different enzyme systems, for instance, and just that.  
20 The 2,4-D wouldn't work very well on any of them, but  
21 with a high enough concentration there is sufficient  
22 minor interruption to the point where there would be  
23 dysfunction, but that is at very high -- that is at  
24 lethal doses, for instance, or at sublethal doses if  
25 that is the end point that is being monitored.

1 Q. Okay. And just so I'm clear on your  
2 evidence, Mr. Craig, with respect to this point  
3 generally, would you agree that animals are sensitive  
4 to, let me use 2,4-D as an example, even though their  
5 metabolic processes and pathways are different from  
6 plants?

7 A. Well, sensitive is a relative term.  
8 Sensitivity is really reference to the concentration of  
9 say 2,4-D required to produce an effect in a plant  
10 versus the concentration required to produce an effect  
11 in a mouse. What one would find is that much less of  
12 the 2,4-D would be required to produce an effect in a  
13 plant, let's say mortality, than a mouse, and so in  
14 that regard mice are less sensitive to 2,4-D than  
15 plants. But if you load a mouse up with enough 2,4-D  
16 it will be sensitive to it.

17 What I'm saying is that in the real world  
18 context that the exposure concentrations in the field  
19 of 2,4-D that we're considering would clearly result in  
20 some plant response but the concentrations would be so  
21 far below effect concentrations required in mammals  
22 that I think that generally you would not see the same  
23 kind of response; that is, you would not see ultimately  
24 a mortality in mammal systems that you would in plant  
25 systems.

1                   So that's how I would describe the  
2 sensitivity component.

3                   Q. Let me use a different phrase than  
4 sensitivity since obviously it complicated your answer.

5                   Would it be fair to say that chemicals  
6 are not well received by animals even though they have  
7 different metabolic pathways than plants; is that a  
8 fair statement?

9                   A. Not well received. There is -- I  
10 don't want to confuse the phrase well received,  
11 received with...?

12                  Q. I thought I was on safe ground by  
13 using your terminology.

14                  A. Well, the mammalian systems are not  
15 as sensitive to 2,4-D as plants, they do not have the  
16 same sensitivity.

17                  Q. But they do have a reaction even  
18 though their metabolic pathway may be different from a  
19 plant; is that correct?

20                  A. If the concentrations are sufficient  
21 enough and exceed those threshold levels.

22                  Q. Given those caveats, your answer is  
23 yes?

24                  A. That's true. If the concentrations  
25 are high enough, there can be a response.

1 Q. Thank you. I ask you to refer to  
2 page 29 of your evidence. We're looking here under the  
3 heading Direct Toxic Effects on Terrestrial Animals,  
4 and we're looking at the second sentence in the first  
5 paragraph under that heading.

6 MR. CASSIDY: What page?

7 MR. CASTRILLI: Q. Page 29.

8 MR. CRAIG: A. Yes.

9 MR. CASTRILLI: Q. The sentence reads:

10 "Surface exposure for wildlife is not  
11 likely to represent the most important  
12 route of exposure due to the natural  
13 barrier provided by fur, feathers and  
14 skin."

15 Actually for this question, I'm pleased  
16 to have an answer from Dr. Eedy as well if he cares to  
17 respond. Do wildlife such as birds and mammals - I  
18 don't know if there is anything else - clean themselves  
19 by licking and grooming?

20 A. I would expect so.

21 Q. Sorry, I should probably ask that of  
22 Dr. Eedy. I'm sorry.

23 DR. EEDY: A. Yes, they do.

24 Q. Your answer is...?

25 A. Yes, they do.

1 Q. Thank you. So would it be fair to  
2 say that wildlife can receive a chemical dose from such  
3 cleaning activities as oral ingestion by licking their  
4 skin, fur and feathers?

5 A. Yes, that's possible.

6 Q. And would that also -- well, let me  
7 ask you a different question with respect to amphibians  
8 such as frogs, toads, salamanders and snakes - just to  
9 use my favourite four. Do amphibians absorb toxins  
10 through their skin both on land and in water?

11 A. First off, a snake isn't an  
12 amphibian.

13 Q. A reptile; is that a reptile?

14 A. It's a reptile.

15 Q. All right. Let's leave reptiles out.

16 A. Okay.

17 Q. Let's just do frogs, toads and  
18 salamanders.

19 MR. CASSIDY: Your favourite three.

20 MR. CASTRILLI: My favourite three.

21 MR. CASSIDY: Mine are access, harvest  
22 and renewal.

23 DR. EEDY: Again, I guess they do absorb  
24 things through their skin, but this would depend on the  
25 exposure which would vary somewhat depending on the

1 habitat, for instance, whether they are under water or  
2 in water or directly exposed or whatever.

3 MR. CASTRILLI: Q. Can surface exposure  
4 of pesticides be a significant source of exposure to  
5 amphibians because of their very sensitive skin, Dr.  
6 Eedy?

7 DR. EEDY: A. I'm afraid that that's not  
8 my area.

9 Q. I'm sorry. Mr. Craig?

10 MR. CRAIG: A. Perhaps I could -- skin  
11 is one route of uptake in a classical sense.

12 Q. I'm sorry, were you finished.

13 A. Whether or not more chemical would be  
14 taken up by the animal through the skin as opposed to  
15 another route is open to review. It's a route.

16 Q. Sorry.

17 A. It is a route.

18 Q. It's a route?

19 A. It is possible, yes.

20 Q. You're familiar with the Weeks study,  
21 Mr. Craig?

22 A. Yes, I've been through it, yes.

23 Q. You've relied upon it in writing your  
24 report; did you not?

25 A. Yes, I have.

1                   Q. I wonder before I refer you to that  
2 report, can I just take you back to your evidence on  
3 page 29, the sentence I read into the record a moment  
4 ago, I'll just read it again:

5                   "Surface exposure for wildlife is not  
6 likely to represent the most important  
7 route of exposure due to the natural  
8 barrier provided by fur, feathers and  
9 skin."

10                  Now, we've just talked about the fact  
11 that animals can lick and groom their surface for  
12 feathers and skin. So would you agree with me that in  
13 the circumstances fur, feathers and skin are not a  
14 good -- they're not a natural barrier or they're not a  
15 barrier at all with respect to oral ingestion from  
16 licking and grooming?

17                  A. No, that is true. They still stand  
18 as excellent barriers.

19                  Q. Even though they can ingest it  
20 through -- they can ingest the chemical through licking  
21 and grooming?

22                  A. Yeah, but the route of exposure  
23 through skin --

24                  Q. Is blocked because of the fur,  
25 feathers and skin?

1 A. Yeah.

2 Q. But not through oral ingestion; is  
3 that right?

4 A. I would anticipate that animals  
5 grooming would be able to remove whatever residual is  
6 present on their exterior surface. I still feel that  
7 the greatest opportunity for intake would be through  
8 food in the case of mammal systems, through foraging or  
9 whatnot, rather than just licking their coats.

10 Q. Mr. Craig, I thought you had just  
11 advised the Board that skin was a classical uptake  
12 route?

13 A. Yes, I did. That is one route. The  
14 efficacy of that uptake is going to -- is going to be  
15 determined whether or not the uptake is significant.  
16 We have to take in and consider, Madam Chair,  
17 essentially mass load.

18 Just because a chemical or compound is on  
19 the outer surface of an animal represents a certain  
20 mass and you have to compare the opportunity for that  
21 mass to be removed and ingested either through direct  
22 transport or through grooming as opposed to the  
23 opportunity for that animal to forage and take in the  
24 compound from another source.

25 MADAM CHAIR: So you're saying the

1 concentrations would be higher by food ingestion than  
2 grooming?

3 MR. CRAIG: Yes, on a mass load basis,  
4 assuming the concentrations would be the same, if the  
5 animal were contacted as the rest of the environment  
6 was contacted their total surface area -- outstanding  
7 surface area would be I think -- I suspect relatively  
8 small compared to the total forage surface area, so the  
9 mass load intake from grooming or direct uptake through  
10 skin, I would suggest, would be less than that  
11 available from foraging either from foliage or prey or  
12 whatever else.

13 DR. EEDY: I think to add to his answer  
14 another--

15 MR. CASTRILLI: Q. Yes, please do.

16 DR. EEDY: A. --another thing that one  
17 would have to look at - and I don't believe it has been  
18 studied - is just how much of the spray would actually  
19 get on to the skin of animals, knowing animal behaviour  
20 and especially things like frogs and toads and  
21 salamanders that have perhaps a little more sensitive  
22 skin or ability to transfer liquids through the skin  
23 than mammals or reptiles or birds, and also knowing a  
24 little bit about bird behaviour and mammal behaviour,  
25 et cetera, I believe the potential for exposure to the

1 spraying is probably a great deal less than the  
2 potential for ingestion after the spraying has  
3 occurred.

4 A good majority of these animals are not  
5 going to be directly out in the open at the time that  
6 something is being sprayed.

7 Q. Thank you. Mr. Craig, we were having  
8 a discussion before about the Weeks study and you have  
9 indicated your familiarity with it, it was a document  
10 you relied upon in preparing your evidence; is that  
11 right?

12 MR. CRAIG: A. Yes, that's correct.

13 MR. CASTRILLI: Madam Chair, I would like  
14 to make this the next exhibit.

15 MR. HUFF: (handed)

16 MADAM CHAIR: Thank you, Mr. Huff.

17 This will be Exhibit 1233. It's titled:  
18 The Draft Environmental Impact Statement, Vegetation  
19 Management in the Ozark/Ouachita Mountains, Volume II.  
20 The author is the United States Department of  
21 Agriculture, Forest Service Southern Region, and the  
22 date is June, 1989.

23 ---EXHIBIT NO. 1233: Document entitled: Draft  
24 Environmental Impact Statement,  
25 Vegetation Management in the  
Ozark/Ouachita Mountains, Volume  
II, authored by the USDA Forest

Service, Southern Region, dated  
June, 1989.

MR. CASTRILLI: Q. All right. Mr.  
Craig, we are looking at the bottom of page 7-7 and the  
top of page 7-8. It's the sentence -- the last full  
paragraph -- sorry, the last paragraph on page 7-7  
going over to page 7-8. I will just read the entirety  
of it into the record:

"Fur, feathers and scales afford varying  
degrees of protection against dermal  
exposure; by preventing the chemical from  
reaching the animal's skin, they may  
instead allow the chemical to dry or to  
be rubbed off in their movement. For  
this reason, the dermal penetration rate  
for each herbicide for mammals was  
adjusted for three other animal  
classes--birds, reptiles, and amphibians.  
Dermal penetration factors were  
multiplied by the mammalian penetration  
rate as follows: (1) birds, 0.75; (2)  
reptiles, 0.15; and (3) amphibians, 5.0.  
The amphibian factor is high because the  
moist, glandular skin of the amphibian  
serves to a large extent as a respiratory

1 organ and is much more permeable than the  
2 skin of the other animal classes (30 per  
3 (5 to 93 percent) of body weight in water  
4 moves through skin in 24 hours according  
5 to Moore, 1964).

6 Just focusing then on the amphibian  
7 factor, Mr. Craig, would you agree with the assessment  
8 provided by Weeks that amphibians due to moist  
9 glandular skin are going to absorb more toxin through  
10 their skins?

11 MR. CRAIG: A. Yes, that's reasonable.

12 DR. EEDY: A. I think again, if I might  
13 add to that --

14 Q. Please do, Dr. Eedy.

15 A. That my interests are in behaviour  
16 and one of the reasons why amphibians can survive with  
17 that kind of skin is that they do not sit directly out  
18 in the sun in most cases or directly out in the area  
19 that they would be exposed to herbicide application.

20 It doesn't mean that they could not be  
21 exposed, but I would expect that animals that, to a  
22 large extent, live in the aquatic habitat or under logs  
23 and things like that would have a much less chance of  
24 being directly exposed and the concentration factor or  
25 the absorption factor would only work in relationship

1 to how much these animals are exposed.

2 Mr. Craig has indicated that in aquatic  
3 habitat there's a fair bit of dilution which occurs  
4 which would mean that they would have less chance of  
5 being exposed than perhaps a mammal.

6 MR. CRAIG: Madam Chair, I think it's  
7 important to recognize that this is a comparison of the  
8 characteristics of the type of skin on all of these  
9 animals, so we are looking at what they refer to as  
10 penetration rates, so that's how these skins would be  
11 ranked. I would have no disagreement with that.  
12 Really I think the major issue then is opportunity for  
13 exposure.

14 MR. CASTRILLI: Madam Chair, I'm sorry,  
15 you intend to take a break at what time?

16 MADAM CHAIR: Our pattern is 3:10.

17 MR. CASTRILLI: 3:10. Thank you.

18 Q. Mr. Craig, just so I'm clear then on  
19 your testimony on this point, would you agree that  
20 surface exposure of herbicides can be a significant  
21 source of exposure for amphibians?

22 MR. CRAIG: A. Given an equal  
23 opportunity for exposure to all other -- for all other  
24 systems, but -- yes, I will go back to your original  
25 question, the skin will be an important route of uptake

1 for amphibians, yes, that's true.

2 Q. I thought you were coining a phrase  
3 there, equal opportunity exposure. Let me just pursue  
4 this for another moment. For a chemical such as 2,4-D  
5 which is applied aerially, would it be fair to say  
6 there are multiple exposure routes possible?

7 A. Yes, that's possible.

8 Q. And we just discussed one with  
9 respect to animals and amphibians; in a spray area, for  
10 example, they could receive dermal or skin exposure?

11 A. That is one route, yes.

12 Q. Animals or amphibians or others may  
13 also inhale chemical mists from spraying activity?

14 A. Yes, it's possible.

15 Q. And for 2,4-D and the other aerially  
16 applied products, there may also be ingestion through  
17 water, such as drinking water -- or drinking the water?

18 A. Well, yes, yes.

19 Q. And would it be fair to say that a  
20 2,4-D spray may also be ingested by an animal eating  
21 contaminated insects or plants?

22 A. Yes, that's another route.

23 Q. I now refer you to page 31 of your  
24 evidence. We are looking at the first full paragraph  
25 under the heading 2,4-D and we are looking at the

1 second sentence beginning:

2 "Weeks et al. (1988 Section 8, pp. 4-5)  
3 have estimated that only at "extreme  
4 doses" (with application rates of 7.85  
5 kg/ha) does 2,4-D present an unacceptable  
6 risk to wildlife based on the U.S. EPA  
7 risk criterion...", which is described as  
8 one-fifth lethal dose 50; is that correct?

9 A. Yes.

10 Q. And, Mr. Craig, the extreme dose  
11 assumptions that Weeks used are set out in the four  
12 bulleted items directly below that paragraph; is that  
13 right?

14 A. That's right.

15 Q. And would it be fair to say that the  
16 authors of the Weeks study calculated an extreme  
17 exposure for a number of reasons, such as uncertainty  
18 in toxicity data and uncertainty in risk assessment  
19 methods?

20 A. I'm not certain that it would be for  
21 the sake of uncertainty. It's a common approach in  
22 hazard assessment and it allows one to focus on perhaps  
23 a worse case situation which in most times -- in most  
24 instances tends to be an unrealistic set of conditions.  
25 So I'm not -- I don't know about uncertainty though.

1 Q. I refer you again to the Weeks  
2 report.

3 A. Mm-hmm.

4 Q. We are looking now at --

5 MR. CASTRILLI: Sorry, Madam Chair, this  
6 is Exhibit 1233, Section 8, page 1.

7 Q. Looking at the bottom of the page,  
8 the toxicity -- I'm sorry, I'll just read the entirety  
9 of it into the record:

10 "The toxicity of herbicides to wildlife  
11 varies among individuals of the same  
12 species (intraspecific), between  
13 different species (interspecific), and,  
14 often most markedly, between different  
15 classes of animals. Thus, an herbicide  
16 may be more toxic to birds than to  
17 mammals, or more toxic to fish than to  
18 birds. However, toxicity testing has  
19 been conducted on relatively few wildlife  
20 species, and the testing has been  
21 confined to a few avian and mammalian  
22 wildlife species. Laboratory animal  
23 studies have been done on inbred  
24 strains of test animals, particularly  
25 rats and mice, to estimate human

1 toxicity." Well, we don't care about  
2 that last sentence.

3 Just reviewing that last paragraph minus  
4 the last sentence, which I don't think really adds  
5 anything to the discussion, do you agree with that  
6 assessment?

7 MR. CRAIG: A. Yes, that's a  
8 conventional approach to assessing sensitivity of  
9 species.

10 Q. And does that not suggest that there  
11 is uncertainty in the toxicity data and the methods  
12 used in wildlife assessment?

13 A. The uncertainty factor is covered off  
14 by the greater number of species that are tested  
15 undoubtedly; however, what one finds is that the more  
16 species one tests, and this is why in registration  
17 exercises and hazard assessments you will see an  
18 attempt, Madam Chair, to include a number of different  
19 species. So, for instance, a number of rodents, a  
20 mammal, a bird, perhaps two different species of birds,  
21 fish.

22 And as various representative groups of  
23 animal species are tested and their sensitivities  
24 established, one begins to see a broader and broader  
25 spectrum of sensitivity, a range of sensitivities, from

1 very sensitive organisms to more tolerant organisms,  
2 and as each species surrogate is incorporated into the  
3 evaluation one sees less expansion of the range. It's  
4 a matter of diminishing returns.

5 So I would suggest that when there is a  
6 body of information available it incorporates a  
7 representative number of species that have a  
8 representative in the wildlife population, the  
9 opportunity to underestimate the hazard is reduced.

10 So I think, Mr. Castrilli, that  
11 uncertainty can be diminished by increasing the number  
12 of species that are introduced into the hazard  
13 assessment process, whether they are wildlife species  
14 or not.

15 Madam Chair, I would suggest that there  
16 is an opportunity for that type of protection using  
17 that approach.

18 MR. CASTRILLI: Thank you, Mr. Craig.

19 Madam Chair, this would be an appropriate  
20 place to break.

21 MADAM CHAIR: Thank you, Mr. Castrilli.

22 The Board will break for 20 minutes.

23 ---Recess taken at 3:10 p.m.

24 ---On resuming at 3:40 p.m.

25 MADAM CHAIR: Please be seated.

1 MR. CASTRILLI: Thank you, Madam Chair.

2 Madam Chair, before we continue with the  
3 questioning, it was brought to my attention when I was  
4 reading page 8-1 at the bottom, of Exhibit 1233, when I  
5 read the last sentence into the record, which states:

6 "Laboratory animal studies have been  
7 done on inbred strains of test animals,  
8 particularly rats and mice, to estimate  
9 human toxicity."

10 I said I wasn't interested in that, or  
11 that wasn't important. I only meant that in relation  
12 to the question I was asking of this panel, and I don't  
13 want it to be construed that that is not a concern of  
14 my client and that it won't be dealt with later.

15 Q. Now, Mr. Craig, continuing with you,  
16 I was interested in an answer you gave to a question I  
17 asked before the break. I believe you stated that the  
18 opportunity to underestimate hazard is reduced when the  
19 number of species is increased. Was that your  
20 testimony?

21 MR. CRAIG: A. Yes, that's correct.

22 Q. I refer you to page -- sorry, and  
23 that, therefore, is a means of dealing with the  
24 uncertainty in the toxicity data; is that correct?

25 A. Yes, it reduces the uncertainty.

1 Q. And as I understand that, you  
2 therefore have to have a large number of species to in  
3 fact overcome the uncertainty in the toxicity data; is  
4 that correct?

5 A. That's correct.

6 MADAM CHAIR: Excuse me, Mr. Craig. Were  
7 you saying you have to have a large number of species,  
8 or you have to have a representative number of species?

9 MR. CRAIG: No, sorry, Madam Chair. What  
10 I'm saying is that the larger the number of species  
11 sensitivity that you have at hand, the information you  
12 have at hand, the more your uncertainty is reduced.

13 There will always be an element of  
14 uncertainty, but what I tried to indicate is that if  
15 you can select representative organisms, like two or  
16 three rodents, some mammals, an ungulate, and you try  
17 to get information on those kind of representative  
18 groups it's possible -- well, it clearly reduces the  
19 uncertainty in determining the levels of exposure that  
20 represent the least risk or a lower level of risk to  
21 that representative group of organisms.

22 That's a principle, the approach that one  
23 would take in hazard and risk assessment.

24 MADAM CHAIR: The point you made earlier  
25 about diminishing returns had to do with the number of

1 animals and each of their representative species?

2 MR. CRAIG: Well, it's just that the more  
3 species you try to include in your database the more  
4 effort is required to gather that information, whether  
5 you do the work or collect the work, then you will  
6 advance the sensitivity of understanding.

7 For instance, if the range of toxicity  
8 you identify is, let's say, one milligram per kilogram  
9 body weight to a hundred, based on 20 organisms, if you  
10 increase that to a hundred you may only move your  
11 margins out one and a half to maybe 150. So for the  
12 additional effort you go to you don't get a lot more  
13 information.

14 MADAM CHAIR: Thank you.

15 MR. CASTRILLI: Q. Mr. Craig, page 8-1  
16 of Exhibit 1233, and again I'm looking at the bottom of  
17 the page.

18 A. Yes.

19 Q. The next to the last sentence which  
20 says, "However, toxicity testing...", do you have that  
21 sentence?

22 A. Yes, I see it.

23 Q. I will just read the entirety of the  
24 sentence into the record again:

25 "However, toxicity testing has been

1                   conducted on relatively few wildlife  
2                   species and the testing has been confined  
3                   to a few avian and mammalian wildlife  
4                   species."

5                   I take from that sentence, Mr. Craig,  
6                   that we, therefore, don't have a large number of  
7                   species or Weeks did not have a large number of species  
8                   to review in his study, and that is one of the  
9                   functions of why he used an extreme dose or  
10                  conservative dose estimate; isn't that right?

11                  A. Yes, that would be his application of  
12                  a safety factor component.

13                  Q. All right, fine. And would it be  
14                  fair to say we see that again referenced at page 8-4?

15                  I'm now looking at the third full  
16                  paragraph on the page just above the subheading in the  
17                  middle of the page, the last sentence:

18                  "However, the conservatism used in  
19                  estimating the wildlife doses should  
20                  compensate for much of the uncertainty in  
21                  the toxicity database."

22                  So again we have Weeks indicating that he  
23                  used a conservative approach, that is to say, an  
24                  extreme dose estimate to overcome or to compensate for  
25                  the uncertainty in the toxicity data; is that a fair

1 statement?

2 A. Yes, that's reasonable.

3 Q. Thank you.

4 MR. FREIDIN: Could you just indicate  
5 where that last reference was, Mr. Castrilli?

6 MR. CASTRILLI: Yes, it's page 8-4 of  
7 Exhibit 1233 and it's the last sentence in paragraph 3.

8 MR. FREIDIN: Thank you.

9 MR. CASTRILLI: Q. So, Mr. Craig, just  
10 so I'm clear on this, Weeks was of the view that he  
11 required -- it was important for him to have an extreme  
12 dose estimate to account for sensitivity of species he  
13 doesn't know anything about; is that a fair statement?

14 MR. CRAIG: A. Yes, that's reasonable.

15 Q. Thank you. Now, Mr. Craig, just  
16 continuing with you and continuing in Chapter 8 of the  
17 Weeks study. Weeks, as I understand it, calculated two  
18 types or estimated two types of doses, what he called a  
19 realistic dose and an extreme dose; is that right?

20 A. Yes, that's my understanding.

21 Q. And we can see that exemplified for  
22 example at Table 8-1 at page 8-5 of Exhibit 1233?

23 A. Yes.

24 Q. And this is a table entitled: 2,4-D  
25 wildlife and domestic animal doses compared with

1 laboratory acute toxicity. And we see that on this  
2 page both an extreme dose and a realistic dose estimate  
3 was calculated; is that right?

4 A. Yes.

5 Q. Now, Mr. Craig, just looking at the  
6 extreme dose column, extreme dose estimate column which  
7 is the second column on Table 8-1.

8 A. Yes.

9 Q. Would you agree with me that there  
10 are many species on this page - leave aside domestic  
11 animals for the moment - that there are many species on  
12 this page which exceed the U.S. EPA risk criterion of  
13 one-fifth lethal dose 50 under the extreme dose  
14 estimate column?

15 A. Yes, there are a number.

16 Q. Just so we have this clear on the  
17 record. With respect, first of all, to birds or  
18 species of birds, can you confirm for me that five of  
19 the six species identified on Table 8-1 of the Weeks  
20 study exceed the one-fifth lethal dose 50?

21 A. Yes, that's correct.

22 Q. And with respect to mammals, going  
23 down to the middle of Table 8-1, can you confirm for me  
24 that eight of the 11 mammal species exceed the  
25 one-fifth lethal dose 50 concentration?

1 A. Sorry, how many did you say?

2 Q. I said eight of 11.

3 A. I only get seven.

4 Q. Seven, all right. Your math is  
5 better than mine, seven out of 11, and I was including  
6 amphibians. With respect to amphibians--

7 A. Oh.

8 Q. --there is one out of the one?

9 A. Yes.

10 Q. --amphibian exceeds the one-fifth  
11 lethal dose 50 concentration?

12 A. That's correct.

13 Q. And with respect to reptiles, two of  
14 the three reptiles exceed the one-fifth lethal dose  
15 concentration?

16 A. Correct.

17 Q. Thank you. Now, let's compare the  
18 extreme dose estimate with the lethal dose 50, and can  
19 you confirm for me that three species on Table 8-1  
20 exceed the -- under the lethal dose estimate, exceed  
21 the lethal dose 50 for those species, in particular -  
22 I'm sorry, let's just speed this up - the shrew, the  
23 bat and the vole?

24 A. Yes.

25 Q. And, Mr. Craig, the lethal dose 50

1 are the concentrations at which 50 per cent of the test  
2 animals die?

3 A. That's correct.

4 Q. Mr. Craig, do we know or does this  
5 Board know -- or let me put the question to you this  
6 way: Do Ontario exposure levels lie somewhere between  
7 the realistic and extreme dose level, in your opinion  
8 as defined by Weeks?

9 A. I would have to refer back to the  
10 application rate that was used and cross-reference  
11 that, those numbers. Offhand I can't recall exactly.  
12 I'd have to make that cross-reference to agree with  
13 you.

14 Q. Do you want to consider that over the  
15 evening and advise us on the record tomorrow?

16 MR. CASSIDY: Well --

17 MR. CASTRILLI: I mean, if you know.

18 MR. CASSIDY: Yes, if the witness is able  
19 to do it overnight. It may be something that he may  
20 find in the morning requires further effort. So I  
21 wouldn't want it to be taken that he can't do it just  
22 because he can't do it overnight.

23 So maybe we can just take it under  
24 advisement that if he's able to he'll try overnight.

25 MR. CASTRILLI: That's fine. I'm

1 assuming that it's in his evidence and in his report  
2 and if it's not there and it's going to be more  
3 difficult to do that, then we will deal with that in  
4 the tomorrow.

5 MADAM CHAIR: Mr. Craig, at the end of  
6 the day if you wanted to review your list of  
7 undertakings with Mr. Castrilli -- have you gotten  
8 everything down that he's asked you to do?

9 Certainly feel comfortable, if you want  
10 to go through it again and ask --

11 DR. EEDY: I think we will because some  
12 of them were uncertain as to whether they were really  
13 undertakings.

14 MADAM CHAIR: All right. Well, we will  
15 spend a few minutes at the end of the day making sure  
16 the witnesses know what the undertakings are.

17 MR. CASTRILLI: I think at this point,  
18 Madam Chair, this may be the only one.

19 Q. Mr. Craig, do doses depend on more  
20 than application rate?

21 MR. CRAIG: A. They would be driven  
22 primarily by consumption rates.

23 Q. Consumption rates?

24 A. Yeah, consumption rates and the  
25 exposure in this case of the food source, the potential

1 food source. As I understand it, these estimates are  
2 based on consumption, they are calculated on  
3 consumption.

4 Q. So they exclude dermal and inhalation  
5 sources of exposure?

6 A. Yes. Well, that would be my  
7 understanding because I assume that's what Weeks did is  
8 he used a low fraction, or a fraction of the LD50 which  
9 is one-fifth, to accommodate those other considerations  
10 which -- he used it as a conservative approach.

11 Q. Mr. Craig, as a general proposition  
12 do you agree with the view that aerial spraying  
13 increases the expected exposure estimates above ground  
14 mechanical spraying estimates with respect to water  
15 pollution?

16 A. In that there is -- I would agree  
17 with that, in that the ground applications are perhaps  
18 more controlled; whereas, if they are conducted by a  
19 single individual they can generally keep their nozzle  
20 pointed away from a stream, close to a plant. That's  
21 what I would agree with.

22 Q. Let's take an example, perhaps 2,4-D  
23 concentrations in water, for example --

24 MR. FREIDIN: I'm not sure whether this  
25 witness has been qualified as an expert in the

1 application of insecticides or pesticides of any type,  
2 the application of them.

3 MR. CASTRILLI: Well, I'm not asking a  
4 question about that.

5 MR. FREIDIN: Well, you're asking  
6 questions about whether one type of application results  
7 in more exposure to aquatic environment, and unless  
8 he's an expert in that area I'm not sure whether he's  
9 qualified to answer those kinds of questions.

10 MR. CASTRILLI: Well, Madam Chair, the  
11 matter is dealt with in the Weeks report and this  
12 witness has relied on the Weeks report, so to that  
13 extent he can answer the question. In any event, I'm  
14 not about to ask him to start measuring nozzles, those  
15 are not the directions of my questions.

16 MADAM CHAIR: What is your follow-up  
17 question, Mr. Castrilli?

18 MR. CASTRILLI: It was concentrations in  
19 water could be higher due to things -- from aerial  
20 spraying could be higher due to things such as drift  
21 into waterways.

22 MR. CASSIDY: That is getting close,  
23 Madam Chair. In terms of what this witness is about,  
24 in terms of how concentrations increase, he's talked  
25 about the effect of increased concentrations, but I

1 don't think his expertise goes to necessarily how those  
2 concentrations might increase.

3 MADAM CHAIR: Certainly Mr. Craig did  
4 make a statement earlier to the effect that drift or  
5 overspraying into water would be a worse case scenario  
6 in terms of the exposure profile. I don't know if you  
7 have anything to add to that.

8 MR. CASTRILLI: I think I can clear this  
9 up, Madam Chair.

10 MR. CRAIG: Mine is a mechanical judgment  
11 only, it's not an expert judgment.

12 MR. CASTRILLI: Q. Well, I'm not asking  
13 for a lay assessment, Mr. Craig. Let me refer to page  
14 7-9 of the Week study. We are looking at the middle of  
15 the page. Let me read a portion of the paragraph into  
16 the record:

17 "Water is assumed to be drunk in the  
18 realistic case from a stream off-site  
19 that reaches a concentration of  
20 0.001267...", is that one ten thousandth  
21 of a part per million -- sorry, one thousandth of a  
22 part per million, Mr. Craig?

23 MR. CRAIG: A. That's correct.

24 Q. "...per pound of herbicide applied  
25 per acre for aerially applied herbicides

1 and 0.0003...", that's three ten  
2 thousandths of a part per million, Mr. Craig; is that  
3 right?

4 A. Yes, that's right.

5 Q. "...per ground applied herbicides."  
6 Sorry, I'll just read on:

7 "In the extreme case water reaches a  
8 concentration of 0.0068 parts per  
9 million...", that's again six one  
10 thousandths of a part per million; is that right, Mr.  
11 Craig?

12 A. Yes.

13 Q. "...for aerially applied herbicides  
14 and 0.00063 parts per mill...", that's  
15 six ten thousandths of a part per million,

16 "...for ground-applied herbicides."

17 A. Yes.

18 Q. So that the assumptions Weeks worked  
19 with in his study were that aerially applied  
20 applications of herbicides - and he's speaking of  
21 herbicides in general here not 2,4-D in particular -  
22 result in higher levels of herbicide in concentrations  
23 in water than ground applied; is that right?

24 A. That's correct.

25 Q. And that's your understanding? You

1 have to say yes, not nod.

2 A. Yes, sorry. Yes, I understand the  
3 logic here, yes.

4 Q. Thank you. So, Mr. Craig, just so  
5 I'm clear on your evidence on this point, do you agree  
6 with me that the Weeks study confirms that in general  
7 aerial spraying increases exposure estimates above  
8 ground spraying estimates through water exposure?

9 A. Yes.

10 Q. Your answer is...?

11 A. Yes, it is.

12 Q. Thank you. Now, Mr. Craig, I wonder  
13 if you can help me with this, if you know. Did Weeks  
14 perform his assessment for a forest region where 2,4-D,  
15 and I guess for that matter, glyphosate or Vision  
16 aerially spraying does not occur?

17 Let's keep it to 2,4-D, just to keep it  
18 simple.

19 A. I'm sorry, could you repeat that?  
20 Did he...

21 Q. Yes, yes, I'm sorry. Did Weeks  
22 perform his assessment for a forest region where 2,4-D  
23 aerial spraying does not occur?

24 A. And what do you mean by the  
25 assessment rate, I'm not sure?

1 Q. Well, did Weeks do his work - is work  
2 an easier word for you. Let me repeat the question and  
3 I'll substitute the word work, if that helps you.

4 A. Okay.

5 Q. Did Weeks perform his work for a  
6 forest region where 2,4-D aerial spraying does not  
7 occur?

8 A. Where it does not occur? Do you mean  
9 the geographical area that he studied?

10 Q. Yes. When I say forest region, I  
11 suppose it could mean geographic, but I think in this  
12 sense it also refers to the particular forest region  
13 that was the subject of the study he did his work for,  
14 I mean, if you know -- or if you don't know, just say  
15 you don't know.

16 A. I'm just not clear. I'd have to go  
17 back over the study area and historical review and that  
18 sort of thing. I just can't place it.

19 Q. All right. Well, perhaps we can just  
20 sort this out. Let me refer you first of all to page  
21 2-3, this is of the Weeks study.

22 This is a table entitled -- sorry, it's  
23 Table 2-1, it's entitled: Number of acres treated  
24 annually with herbicides in Region 8 by application  
25 method.

1                   Region 8 presumably refers to the  
2 particular U.S. forest region that they committed the  
3 study for, and can I direct your attention to footnote  
4 b at the bottom of the page.

5                   A. I'm sorry, that is d?

6                   Q. b, as in boy.

7                   A. Okay.

8                   Q. I'm sorry, b refers first of all to  
9 aerial at the top of the page, do you agree, the  
10 footnote?

11                  A. b, yes.

12                  Q. Your answer...?

13                  A. Yes, that's right.

14                  Q. And looking now at footnote b, the  
15 footnote indicates:

16                         "estimated potential use; not currently  
17 applied by air."

18                         Does that help you in answering the  
19 question I asked you earlier?

20                   A. Well, of the aerial -- well, the  
21 table discusses the forms of herbicide that were used  
22 by various means, either aerial applications,  
23 mechanical or manual, it refers to foliar, granular or  
24 pellet, and that's the estimated use.

25                   I'm not sure where that puts 2,4-D which

1 is one of your earlier questions.

2 Q. Okay. Let's turn to Table 7-6, page  
3 7-13 of the Weeks study.

4 A. Yes.

5 Q. Now, this is a table entitled:  
6 Herbicide concentrations in water in parts per million.

7 A. Yes.

8 Q. And just looking at the 2,4-D amine,  
9 2,4-D ester and I think it's 2,4-D amine and ester?

10 A. Yes.

11 Q. And the subheading Spill in  
12 Reservoir, and there's footnote a?

13 A. Yes.

14 Q. And the footnote a says:  
15 "no aerial use"

16 A. Yes.

17 Q. Was 2,4-D applied aerially or is  
18 2,4-D applied aerially in Region 8?

19 A. It appears that it is with reference  
20 to the offsite drift.

21 Q. Okay, so you believe it is with  
22 respect to offsite drift?

23 A. Yes.

24 Q. Okay. Let's look at page 7-3 of the  
25 Weeks Study. We're looking now under the heading

1 Wildlife Exposure Estimates and we're looking at the  
2 second paragraph under that heading, the last sentence  
3 which reads:

4 "exposures for realistic and extreme  
5 cases were based on the typical and  
6 maximum herbicide application rates  
7 for ground mechanical applications (table  
8 7-3)."

9 Does that help you as to whether 2,4-D is  
10 applied aerially in Region 8?

11 A. Well, there's clearly mention of  
12 ground mechanical applications in Table 7-3. I'm  
13 having difficulty with the aerial application. You're  
14 referring to planes, are you?

15 Q. That's what I believe. Sorry, I  
16 presume aerial is not restricted to planes, but it does  
17 mean from the air.

18 A. Yeah.

19 Q. Helicopters, airplanes, whatever.

20 A. Yeah. I see there is reference to  
21 the 2,4-D Table 7-1 as a result of aerial applications,  
22 so...

23 Q. Well, just focusing on how Weeks did  
24 his exposure estimates, would it be fair to say that he  
25 calculated 2,4-D exposure from ground mechanical spray

1 applications with respect to wildlife and not from  
2 aerial spraying?

3 A. Yes, that's that one sentence on  
4 7-3 -- page 7-3 says, yes.

5 Q. So does that help you, Mr. Craig, in  
6 determining whether exposure levels in Ontario lie  
7 somewhere between Weeks realistic and extreme dose  
8 particularly with respect to water exposure?

9 A. I see the rates listed on Table 7-3  
10 on page 7-6 and those are, at that range of typical or  
11 maximum, consistent with other application rates.

12 Q. Those are actually the application  
13 rates that you rely on in page 31 of your evidence?

14 A. True.

15 Q. And we can see from Table 7-3 they  
16 were taken from ground mechanical applications in  
17 Region 8 and not from aerial?

18 A. Yes.

19 Q. Thank you.

20 MADAM CHAIR: Mr. Castrilli, I'm having a  
21 bit of confusion about this evidence because I think we  
22 had evidence from an earlier panel to the effect that  
23 higher concentrations of active ingredient are sprayed  
24 by ground spraying than by aerial spraying.

25 MR. CASTRILLI: I think we've had that

1 evidence, that's certainly true, but I think it's clear  
2 from what we've just gone through with this witness  
3 that at least with respect to water exposure the  
4 expected concentrations are expected to be greater from  
5 aerial in water than from ground.

6 It's clear from the material that Mr.  
7 Craig has agreed to as we've gone through this report  
8 that that's the case.

9 MADAM CHAIR: And the assumption with  
10 that is that aerial spraying has -- there has been  
11 overspraying or drift into water?

12 MR. CRAIG: That's right.

13 MR. CASTRILLI: Yes, that's right.

14 MADAM CHAIR: Okay.

15 MR. FREIDIN: I don't think, Madam  
16 Chair - just for the record, I'd like indicate what my  
17 objection was before. I don't think this witness has  
18 indicated that the case is, or has agreed that there is  
19 a higher rate of application or dose aurally versus  
20 manually.

21 He said that that was the assumption that  
22 Weeks made and he accepts Weeks' assumption, and he's  
23 indicated that he doesn't have the professional  
24 qualifications, that it was a lay decision or view when  
25 he was asked specifically on that particular matter.

1 MR. CASTRILLI: Well, Madam Chairman, I  
2 don't accept the caveat of Mr. Freidin. It's clear on  
3 the face of the document prepared by Mr. Craig what it  
4 was he was relying upon when he prepared this evidence.  
5 What it was he was relying upon was the Weeks study.

6 And we've just gone through what the  
7 Weeks study says with respect to this issue. So we  
8 don't need any editorial comments from Mr. Freidin with  
9 respect to the Weeks study. Mr. Craig is fully  
10 qualified to understand and explain the Weeks study to  
11 us.

12 MADAM CHAIR: Well, let me just clarify  
13 one other point. What you're trying to determine here  
14 is a statement that Mr. Craig has made on page 31 to  
15 the extent that the Weeks study assumed extreme dose  
16 estimates. That's essentially where we started.

17 MR. CASTRILLI: Yes, that's right.

18 MADAM CHAIR: And then we went through  
19 the Weeks paper in terms of whether those were aerial  
20 applications or ground spray. Mr. Craig has made the  
21 statement that if it were aerial applications they  
22 would be higher doses if they entered water.

23 MR. CASTRILLI: Yes, that's my  
24 understanding of his testimony.

25 MADAM CHAIR: But what he relied on for

1 the statement was page 7-6 Table 7-3.

2 Is that what you said, Mr. Craig, when  
3 you made the estimates -- when you looked at Weeks,  
4 what you call extreme dose estimates, you were taking  
5 it from the table on 7-3?

6 MR. CRAIG: That's correct.

7 MADAM CHAIR: And to your point of view  
8 does it matter whether it was ground or aerial spray,  
9 you're simply looking at the size of the dose?

10 MR. CRAIG: That's right, I'm looking at  
11 the rate of application.

12 MADAM CHAIR: And you would call that an  
13 extreme dose?

14 MR. CRAIG: That's right.

15 MADAM CHAIR: If there were an exposure  
16 to it at that level?

17 MR. CRAIG: That's correct.

18 MADAM CHAIR: Okay.

19 MR. CASTRILLI: Q. Can I refer the panel  
20 now to page --

21 Madam Chair, I think you'll recall that  
22 before I began I indicated I was going to make one  
23 brief foray into an area other than Section 3 of the  
24 evidence, and it will be clear in a moment why I do  
25 that, and it is, I assure you, for just a very limited

1 purpose.

2 Q. Can I refer you, Mr. Craig, actually  
3 the whole panel to pages 13 and 14 of your evidence.  
4 This is the area of concern identification that you --  
5 I forget who actually did it, was it Dr. Eedy?

6 MR. CASSIDY: No, it was Dr. Schiefer.

7 MR. CASTRILLI: Dr. Schiefer, I'm sorry,  
8 Dr. Schiefer.

9 Q. You referred to this in your  
10 evidence-in-chief. Let's see if I can just synthesize  
11 it for you.

12 If I understand your evidence, Dr.  
13 Schiefer, your proposal or the proposal of Beak is that  
14 buffer areas -- buffer zones should only be kept for  
15 those small headwater streams which provide spawning  
16 and/or rearing habitat for cold water fish populations  
17 in downstream lakes or river systems?

18 DR. SCHIEFER: A. Those would be two  
19 criteria. There would be additional criteria as I  
20 outlined, for instance, criteria that would relate to  
21 the maintenance of adequate water quality downstream  
22 would also need to be considered, avoidance of erosion  
23 as an example.

24 Q. Can I ask you to refer to the top of  
25 page 14 of your evidence. Looking at the last sentence

1 in the first paragraph which says:

2 "Exceptions would be those small  
3 headwater streams which provide spawning  
4 and/or rearing habitat for cold water  
5 fish populations in downstream  
6 lakes or river systems."

7 Basically what I read into the record a  
8 moment ago. When you say exceptions, I take it to mean  
9 that first order streams that meet the criteria in that  
10 last sentence are streams that you would continue to  
11 want to see the buffers applied to; is that right?

12 A. That's correct.

13 Q. Are there any others that you  
14 identify in this paragraph where you would want to keep  
15 the buffer zones in tact with respect to first order  
16 streams?

17 A. I think the context of this paragraph  
18 is that the designation of areas of concern should use  
19 site-specific criteria and that all first order streams  
20 need not be automatically included as areas of concern.

21 An exception to that are small headwater  
22 streams which provide critical and/or rearing habitat.  
23 You could replace that terminology with critical  
24 habitat for cold water fish populations.

25 In other words, that if that fact is

1 known, then that particular first order stream should  
2 automatically be an area of concern regardless of other  
3 site-specific criteria; however, if that is not the  
4 case, then there are a number of other criteria which  
5 are listed in this paragraph which should be used to  
6 determine whether it's appropriate and necessary to  
7 include that first order stream in an area of concern.

8 Q. The other criteria you were referring  
9 to are in the first -- sorry, the second full sentence  
10 on page 14 at the top?

11 A. Yes.

12 Q. And for those you would have to  
13 engage in site-specific analysis; is that your  
14 testimony, before you would decide to remove the first  
15 order stream from buffer zone protection?

16 A. To get the full benefit of  
17 designating an area of concern for protection of  
18 aquatic resources, those kinds of criteria should be  
19 included, yes.

20 Q. Would the effect of your proposal be  
21 to remove the first order streams from no-spray zones?

22 A. Well, the criteria I use here are  
23 purely for protection of aquatic habitat related to  
24 harvesting activities and I think that -- I think if  
25 you refer to the Guidelines for Protection of Fish

1 Habitat, where the designation of AOCs is identified,  
2 it's specifically for those -- for that purpose, for  
3 harvesting activities.

4 Q. So your proposal is not in relation  
5 to removing buffer zones from first order streams with  
6 respect to spray operations; is that right?

7 A. Neither including or precluding.

8 Q. I'm sorry, I don't understand that  
9 answer. Is your proposal -- would your proposal have  
10 the effect of removing no-spray zones from first order  
11 streams?

12 A. No, I don't believe it would.

13 Q. And it's not your intent; is that  
14 right? It's not the intent of your proposal to do  
15 that?

16 A. Well, the proposal really does not  
17 relate to the consideration of spraying. The concept  
18 of a buffer zone within an area of concern with this  
19 particular consideration relates to the Guidelines for  
20 Protection of Fish Habitat specifically related to  
21 harvesting activities not related to spraying.

22 Q. Okay. So neither -- just so I'm  
23 clear on this Dr. Schiefer - this will actually save us  
24 some time I think - neither the proposal's intent nor  
25 its effect is to remove no-spray zones from first order

1 stream buffer zones; is that right, or buffer zones  
2 from first order streams?

3 A. That's correct, if those buffer zones  
4 exist. I'm not sure they exist.

5 Q. I think I will cogitate on that last  
6 answer for overnight and move on.

7 Mr. Craig, as a general proposition would  
8 it be fair to say that the degradation of herbicides  
9 such as, I will use 2,4-D as an example, is slower in  
10 colder northern Ontario temperatures than what you  
11 would expect in a warmer southern climate such as where  
12 Weeks performed his assessment?

13 MR. CRAIG: A. Well, colder temperatures  
14 will reduce the rate of degradation, but in northern  
15 Ontario my personal experience is - and perhaps some of  
16 my colleagues might confirm this from their field  
17 experience - the water temperatures are cooler year  
18 round anyways, so I'm not sure -- I really don't know  
19 how different the temperatures would be. I would  
20 suspect not much.

21 DR. SCHIEFER: A. In fact, if I might  
22 add to that, they would only differ during the open  
23 water season, during the season of ice cover there is  
24 no difference.

25 MADAM CHAIR: Isn't the question though

1       whether the water -- the fact that it is colder  
2       altogether in northern Ontario than it is in Alabama,  
3       wherever the Weeks study was done, would mean that  
4       2,4-D degrades slowly; the comparison is northern  
5       Ontario versus the southern United States?

6               MR. CRAIG: Well, given that stream  
7       temperature would be typically warmer in the southern  
8       states, but even then there is -- yeah, certainly  
9       Canadian -- northern Ontario winters are colder than  
10      they are in the Alabama summers as well I would  
11      imagine, so the temperature would be expected to be  
12      colder in Ontario, yes.

13             MADAM CHAIR: So the chemical, the  
14      compound 2,4-D would degrade more slowly in northern  
15      Ontario, but significantly slower or is that...

16             MR. CRAIG: The significance of the rate  
17      is difficult to determine. Typically sort of the basic  
18      principles of thermodynamics require that for every 10  
19      degree change there is a doubling or a half in the  
20      rate.

21             So if the average temperature was 20  
22      degrees in one place and 30 degrees in another, you  
23      would expect a rate of degradation to be half at 20  
24      degree to the 30 degree climate. So there's a 10  
25      degree difference in the 50 per cent increment or

1 decrement.

2 I think I would expect, Madam Chair, that  
3 some other factors would play an important role as well  
4 and that is the availability of bacteria, nutrients,  
5 sediment, suspended sediment availability, sunlight,  
6 many other factors. So temperature alone would not be  
7 a single component, but generally I would expect it to  
8 be slower in a colder environment.

9 MR. CASSIDY: I'm sorry, I would  
10 expect...?

11 MR. CRAIG: But I would expect the rates  
12 to be slower in a colder environment, but I couldn't  
13 comment on the significance of that rate difference.

14 MR. CASTRILLI: Q. And, Mr. Craig, would  
15 your answer be the same with respect to soil, the  
16 capability of soils to degrade herbicides in northern  
17 climates versus southern climates?

18 MR. CRAIG: A. All other things being  
19 equal, yes.

20 Q. If you know, do soil bacteria  
21 function below certain temperatures in terms of their  
22 capability for degrading herbicides?

23 A. Yes. Again, I would expect from  
24 biodegradation studies that lower temperature would  
25 reduce that rate of degradation due to the bacteria.

1                   Q. Thank you. Would it be fair to say  
2                   that if a large area -- I'm sorry, let me state that  
3                   again. Would it be fair to say that if an area is  
4                   sprayed aurally and it's an area larger than a ground  
5                   mechanical -- typical ground application, would it be  
6                   reasonable to assume that a higher proportion of an  
7                   animal's diet in the forest would consist of  
8                   contaminated items?

9                   Let me restate that question. I'm sorry,  
10                  it wasn't very well put.

11                  If a large area is sprayed aurally,  
12                  would it be reasonable to assume that a higher  
13                  proportion of an animal's diet in the forest would  
14                  consist of contaminated items than if only ground  
15                  spraying occurred?

16                  A. You said a larger area would be  
17                  covered, or more food, more foliage?

18                  Again, Madam Chair, I'm not entirely  
19                  familiar with the efficacies of various application  
20                  systems, so I'm somewhat hesitant to agree with you on  
21                  an expertise basis, Mr. Castrilli.

22                  DR. SCHIEFER: A. I think a partial  
23                  answer to that question depends on the home range of  
24                  the species you're talking about and the dietary --  
25                  well, the dietary conditions of that species.

1 Q. Mr. Craig, continuing with you.

2 Would you agree with me that forage vegetation may be  
3 contaminated with higher concentrations of 2,4-D in the  
4 area of the undertaking than was estimated by Weeks in  
5 his study?

6 MR. CRAIG: A. I'm not sure that I could  
7 necessarily agree with you. The actual coverage and  
8 the application or the concentrations are very much  
9 dependent on the way the application is conducted, and  
10 it could well be that they would be very similar if you  
11 compare ground versus aerial.

12 And, again, I'm just not familiar with  
13 all the niceties of the two methods.

14 Q. Sorry, perhaps I've led you astray.  
15 Perhaps the easier way to deal with this matter is to  
16 refer you to page 7-9 of Exhibit 1233. We're looking  
17 at the middle of the page.

18 A. Yes.

19 Q. Where we have a list of realistic and  
20 extreme doses for various types of items such as grass,  
21 forage, seeds, insects and berries. Just focus on  
22 berries for a second.

23 Looking at the berries column under  
24 realistic and extreme, would you agree with me that the  
25 realistic dose scenario is 0.02 parts per million?

1 A. Yes.

2 Q. That's two one hundredths of a part  
3 per million?

4 A. Yes.

5 Q. And under the -- and the range goes  
6 up to 1.6 parts per million under the extreme dose  
7 scenario?

8 A. Yes.

9 Q. And isn't your evidence that  
10 blueberries in Ontario can have greater concentrations  
11 than that of 2,4-D?

12 A. Sorry, would you say that again,  
13 please?

14 Q. Isn't it your evidence that  
15 blueberries in Ontario can have greater concentrations  
16 than the concentrations that we see at page 7-9 with  
17 respect to 2,4-D?

18 Perhaps I can refer you to page 25 of  
19 your evidence. We're looking at paragraph 3, the first  
20 paragraph under 2,4-D.

21 A. Yes.

22 Q. In that paragraph you indicate that:  
23 "Blueberries in Ontario have been found  
24 with 2,4-D residues greater than 10 parts  
25 per million."

1 A. Yes.

2 Q. Is that right?

3 A. Yes.

4 Q. So would you agree with me -- first  
5 of all, let me ask you: I am taking forage vegetation  
6 to include blue berries; is that a fair thing to do?

7 A. I suppose so. I think the panel  
8 would probably support me in that area.

9 Q. All right. Subject to any discounts,  
10 I imagine. Would you agree with me that forage  
11 vegetation such as blueberries can be contaminated with  
12 higher concentrations of 2,4-D in the area of the  
13 undertaking than was estimated by Weeks?

14 A. Yes. That's certainly the case in  
15 these two pieces of information, yeah.

16 Q. Now, Mr. Craig, continuing with you.  
17 I understand your testimony to be that the  
18 environmental residues of 2,4-D which may persist in  
19 blueberries such as the 10.7 parts per million are  
20 unlikely to cause adverse toxic effects to terrestrial  
21 herbivores and omnivores--

22 A. Yes.

23 Q. --such as black bears?

24 A. Yes.

25 Q. I think that was one of your

1 examples?

2 A. Yes.

3 Q. It's page 32 of your evidence.

4 A. Yes.

5 Q. Now, can I again refer you to the  
6 Weeks study, Table 8-1.

7 A. Yes.

8 MR. CASSIDY: Table 8-1?

9 MR. CASTRILLI: Table 8-1, page 8-5.

10 Q. Do you agree with me, Mr. Craig, that  
11 black bears are only one of four species out of 11  
12 mammals listed in Table 8-1 that did not exceed the  
13 U.S. EPA one-fifth lethal dose risk criteria, that's  
14 under the extreme dose scenario?

15 A. Yes, that's one, yeah.

16 Q. So would it be fair to say that black  
17 bears are one of the animals least in danger as a  
18 result of the extreme dose scenario exposure to 2,4-D  
19 under the Weeks investigations?

20 A. The least -- I don't know if they're  
21 the least.

22 Q. I said one of the least?

23 A. One of the least.

24 Q. There are clearly --

25 A. One of those.

1 Q. There are clearly mammals at greater  
2 risk--

3 A. Yes.

4 Q. --on that table.

5 DR. EEDY: A. I think, could I add a  
6 little bit to that answer, because something bothered  
7 me a bit about the one point that was made there, that  
8 three species which exceed the LC 50 at the extreme  
9 dose level are shrews, bats and voles.

10 And if you look at the assumptions he's  
11 making the assumptions are that shrews, in my  
12 interpretation, that shrews, bats and voles eat  
13 vegetation; voles do, shrews and bats don't, that they  
14 are exposed during the spray.

15 I think all three animals -- bats are  
16 nocturnal and generally are in places where they  
17 wouldn't be exposed during spraying because they seldom  
18 spray at night; shrews and voles are generally animals  
19 which live in tunnels either under vegetation or are  
20 even underground.

21 And so, no, I think you have to consider  
22 a number of other things. Black bears are perhaps more  
23 exposed because they do move around in the forest, but  
24 again they tend to be nocturnal, or I guess crepuscular  
25 being out at dusk and dawn when spraying wouldn't

1 occur, but I think this is true of a large number of  
2 animals.

3 And I think that's one of the reasons why  
4 we said that some of these points that Weeks has made  
5 as listed on page 31 of our witness statement, you  
6 know, that all the herbicide sprayed that's  
7 biologically available, that means in terms of the  
8 shrew, one is assuming that everything is sprayed is on  
9 the food that the shrew eats, in the entire diet of the  
10 animal consists of contaminated items.

11 And you know, again, I do think the  
12 extreme doses that he's using, there are quite a number  
13 of fairly unrealistic assumptions when one considers  
14 the behaviour and normal habitat use of these animals.

15 Q. Dr. Eedy, we were actually talking  
16 about the one-fifth lethal dose concentration, not just  
17 the lethal dose.

18 A. Yeah.

19 Q. So we're talking about seven animals  
20 first of all. And secondly,

21 A. Yeah, but one would have to --

22 Q. Sorry, Dr. Eedy, the reporter  
23 couldn't hear me. What I said was, that we're talking  
24 about not the lethal dose concentrations in the  
25 question I put to Mr. Craig, but the one-fifth lethal

1 dose concentrations, so that the mammals that exceed  
2 the one-fifth lethal dose concentration are seven not  
3 three, just for your clarification.

4 A. Yes.

5 Q. And a question to you, Dr. Eedy,  
6 arising out of your intervention. Do shrews and voles  
7 forage on the forest floor?

8 A. They forage on the forest floor, but  
9 in most cases they are living either under litter or  
10 some other thing. They tend to not expose themselves  
11 as much as possible.

12 The voles, for instance, are the things  
13 that leave the little paths underneath the snow and  
14 vegetation that you see in the spring when the snow  
15 melts. They don't tend to be animals that run on the  
16 surface and expose themselves. It's purely a  
17 protection mechanism because they don't want to be  
18 exposed to predators and things like that.

19 Q. Okay. But you'd agree with me, I  
20 think you have, that when they forage, they forage on  
21 the forest floor?

22 A. It depends on what you mean by the  
23 forest floor. I consider the forest -- they could be  
24 under vegetation or under litter and still be on the  
25 forest floor and, in that case, yes.

1 Q. And they could also be on top of it;  
2 couldn't they?

3 A. Well, they can be at times, yes.

4 Q. And with respect to bats, do you  
5 agree with me that they will roost in hollow trees?

6 A. They will roost in a number of  
7 places, yes.

8 Q. Will they roost in hollow trees?

9 A. Including hollow trees and caves.

10 Q. Thank you.

11 Mr. Craig, just to close the circle on  
12 this. In Weeks' extreme dose scenario, berries were  
13 assumed to have a 2,4-D concentration of 1.6 parts per  
14 million; is that right?

15 MR. CRAIG: A. Yes, that's right.

16 Q. And according to real data from  
17 Ontario, blueberries have been found to have  
18 concentration of up to almost 11 parts per million  
19 after spraying; is that right?

20 A. Yes, that's my understanding, yes.

21 Q. Would it be fair to suggest, Mr.  
22 Craig, that perhaps the extreme dose scenario of Weeks  
23 is not so extreme and might actually be within the  
24 realm of a realistic possibility in Ontario?

25 A. Well, yes, that's a reasonable

1 assumption. We have continued that philosophy or that  
2 logic using the higher level of contamination for  
3 blueberries, and in our bear and rabbit model still  
4 identified that on a daily basis there would be a need  
5 for bears to consume two times their body weight and  
6 rabbits 40 times their body weight to meet that  
7 one-fifth and similar LC50 value.

8 So we still identify, that with measured  
9 concentrations in field studies, that there is still  
10 adequate levels of safety there to avoid that one-fifth  
11 LD50 consumption level.

12 Q. Mr. Craig, you recall at the  
13 beginning of my cross-examination of you I asked you  
14 whether wildlife ate various things besides  
15 blueberries?

16 A. Yes.

17 Q. And you recall we discussed bunch  
18 berries and fungi and grass and forage and seeds and  
19 insects.

20 A. Yes.

21 Q. So that all of these things are  
22 capable of being eaten by various types of wildlife;  
23 aren't they?

24 A. Yes, as I understand.

25 Q. And we don't have any data, as far as

1 I can tell you in your evidence, that talks about what  
2 the real concentrations are of 2,4-D residues in some  
3 of these other products; do we -- some of these other  
4 items; do we?

5 A. I would anticipate that they would  
6 certainly at worst be no more than what we cited for  
7 blueberries. I think blueberries, from my personal  
8 experience, are as exposed as any vegetation could be,  
9 that might be used as forage, whether it be fungi or  
10 other berries. So I don't see that it makes much  
11 difference as to what is eaten, given that there is an  
12 equal opportunity for coverage.

13 Q. I see. Can I refer you again to page  
14 7-9.

15 A. Yes.

16 Q. I'm looking again at the middle of  
17 the page, the realistic and extreme dose ranges for  
18 grass, forage, seeds, insects and berries.

19 And would you agree with me that Weeks  
20 assumed, both under the realistic scenario and the  
21 extreme scenario, that berries were the least  
22 contaminated of what he would be looking at and that  
23 grass, forage, seeds and insects would all be more  
24 contaminated, or I should say, would have greater  
25 residues?

1                   A. Well, I see what you're referring to.  
2           Whether we're talking about the berries that Weeks is  
3           referring to, I guess I would say that the blueberry  
4           case that we're referring to is 10 times the 1.6 --  
5           let's say that that's 1, so that would just indicate  
6           that other berries have other potential coverage  
7           concentrations, and we have allowed for that ten-fold  
8           increase factor. So I think we are allowing for a  
9           large number of those other products.

10                  Q. But we don't have any hard data from  
11           you on those other products; do we?

12                  A. No. I used an upper level which is  
13           probably middle of this range of concentrations, so I  
14           wasn't being overly protective in that regard.

15                  MR. CASTRILLI: Madam Chair, we are  
16           sitting until 5:00; is that right?

17                  MADAM CHAIR: Yes, we are, Mr. Castrilli.

18                  MR. CASTRILLI: Thank you.

19                  Q. Mr. Craig, if I could continue with  
20           you. We're now referring to page 32 of your evidence -  
21           there are so many numbers - this one is Exhibit 1222  
22           for the record, and we're looking at the last sentence  
23           immediately -- sorry, we're looking at the second  
24           paragraph on the page.

25                  Your testimony there is that:

1 "There is currently no scientific  
2 evidence of which Beak is aware  
3 indicating significant adverse toxic  
4 effects to terrestrial animals as a  
5 result of 2,4-D use in timber  
6 management."

7 Is that still your evidence?

8 MR. CRAIG: A. Yes.

9 Q. And that's with respect to direct  
10 toxic effects under a heading of your report entitled:  
11 Direct Toxic Effects on Terrestrial Animals; is that  
12 right?

13 A. Yes.

14 Q. I now refer you to page 8 -- sorry,  
15 8-24 of the Weeks report.

16 MADAM CHAIR: Is that page 8-4, Mr.  
17 Castrilli?

18 MR. CASTRILLI: I'm sorry, 8-24.

19 MADAM CHAIR: 24.

20 MR. CASTRILLI: Q. We are looking at the  
21 second paragraph under the heading: Red cockaded  
22 woodpecker.

23 A. Yes.

24 Q. The sentence that begins,  
25 "herbicides..." Do you see that sentence?

1 MR. CRAIG: A. Yes.

2 Q. "Herbicides may affect the red  
3 cockaded woodpecker directly through oral  
4 or dermal doses as was shown for other  
5 wildlife species in this risk assessment.  
6 Two herbicides that appear to present a  
7 significant potential for direct toxic  
8 effects when applied to the woodpecker's  
9 forage or nesting areas are 2,4-D and  
10 2,4-DP."

11 Just stopping there, Mr. Craig. 2,4-DP,  
12 I wonder if you can advise the Board if you know what  
13 the DP stands for?

14 A. I can't recall, I'm sorry.

15 Q. We will move on.

16 A. Yeah.

17 Q. Continuing with the paragraph:

18 "While aerial and ground mechanical  
19 applications of these two herbicides can  
20 pose a serious threat to the birds, hand  
21 applications should not."

22 I'll read the rest of the paragraph, I  
23 want to come back to what I've just read.

24 "The remaining herbicides presenting  
25 moderately low to very low potential

1                   for toxic effects even when it is assumed  
2                   that the red cockaded woodpeakers receive  
3                   a direct spraying and feed exclusively on  
4                   contaminated insects."

5                   It's clear the rest of the paragraph is  
6                   referring to other herbicides than 2,4-D.

7                   Just focussing then on that portion of  
8                   the paragraph I just read into the record that refers  
9                   to 2,4-D -- now, this is under a heading, Mr. Craig, of  
10                  Potential Effects on Threatened or Endangered Species,  
11                  and I understand that the red -- from this report, that  
12                  the red cockaded woodpecker is a threatened or  
13                  endangered bird under U.S. Endangered Species Law,  
14                  which we can simply see by reading the paragraph, page  
15                  8-23.

16                  Now, whether or not this bird exists in  
17                  Ontario, actually I have no idea one way or the other.  
18                  Would you agree with me that the Weeks report on page  
19                  8-24 indicates that 2,4-D aerial spraying may pose a  
20                  serious threat to woodpeckers or birds with similar  
21                  habits?

22                  A. Well, the Weeks conclusion is based  
23                  on the exercise that has an assessment exercise that is  
24                  summarized on Table 8-1 on 8-5.

25                  I think that what they're identifying is

1       that this particular species is more at risk to the  
2       exposure scenarios that have been cited and also the  
3       assumed consumption or habits of those animals, but --  
4       so I can see how the author would have developed this  
5       conclusion for this particular species, that's -- we're  
6       still not aware of direct evidence that there are  
7       adverse toxic effects.

8                   Q.   Well --

9                   A.   This is a risk assessment.

10                  Q.   Mr. Craig, I presume you had this  
11       report, you used it during the course of the  
12       preparation of your work?

13                  A.   Yes.

14                  Q.   When you read the section from Weeks  
15       on the woodpeckers and saw that he had a concern as a  
16       result of risk assessment with respect to a particular  
17       endangered species under U.S. -- or that's protected  
18       under U.S. Law, did you make any further enquiry about  
19       what the potential risk could be to various endangered  
20       or threatened or rare species of terrestrial animals in  
21       Ontario?

22                  A.   We were reviewing the literature for  
23       documented evidence of adverse effects and we cited  
24       what we could locate and we used some of the estimates,  
25       as we explained earlier, that would allow us to

1 determine if toxic levels in the case of mammals in  
2 this case would likely be exceeded.

3 We really felt that the principles of  
4 degradation and dilution and also the opportunity for  
5 other sources of food and other exposure routes would  
6 realistically reduce that risk, and so we didn't go  
7 through an endangered species list by any means.

8 Q. Mr. Craig, can I refer you to page 10  
9 of your report -- sorry, that's of your evidence.

10 And we're looking at the second  
11 paragraph -- sorry, it's the first full paragraph on  
12 the page which refers to both the Endangered Species  
13 Act and COSEWIC. Do you see that paragraph?

14 A. Oh yes.

15 Q. Just noting on that page, the  
16 paragraph indicates that under the regulations there  
17 are approximately -- or there are 12 species of animals  
18 and one plant - that's under the statute and the  
19 regulations - and then pursuant to the COSEWIC Program  
20 living species listed in 1989 included 32 mammals, plus  
21 the down listed wood bison, 29 species of birds, plus  
22 the delisted light pelican, 4 species of reptiles, and  
23 amphibians, 47 species of fish and 54 species of  
24 plants.

25 Now, leaving aside the flora for the

1 moment, did you conduct any studies in preparation for  
2 your evidence to be given here that addressed either  
3 the endangered species liste under the Endangered  
4 Species Act or the additional species listed according  
5 to COSEWIC to determine whether there would be  
6 potential problems of the type raised by Weeks as he  
7 described those problems on page 8-24 of Exhibit 1233?

8 DR. EEDY: a. If I could clarify a bit  
9 before he answers. The COSEWIC list is across Canada  
10 and, consequently, would be more than just what's in  
11 the area of the undertaking.

12 And I believe the Ontario list also  
13 includes all of the province and would also include  
14 more than is within the undertaking area, because I  
15 know several of the species on the list are not in the  
16 area of the undertaking.

17 I might add that the red cockaded  
18 woodpecker is not found, to my knowledge, anywhere in  
19 Canada, anywhere in Ontario.

20 Q. That's fine, Dr. Eedy.

21 A. I mean, if that's --

22 Q. I don't think it matters materially  
23 to the question I put to Mr. Craig and, if necessary,  
24 to you.

25 Whatever the numbers are for the area of

1 the undertaking - and I suspect there is evidence  
2 somewhere in this voluminous record as to what the  
3 numbers are for various species caught by COSEWIC that  
4 are found within the area of the undertaking - can you  
5 confirm for me, Mr. Craig, that you did not do any  
6 studies with respect to what the herbicidal,  
7 particularly the 2,4-D impacts might be on any animal  
8 species in the area of the undertaking that are  
9 pursuant to either the Endangered Species Act or  
10 COSEWIC as it applies to Ontario?

11 MR. CRAIG: A. The studies we undertook  
12 were an information search of the effects of these  
13 herbicides or these pesticides on organisms or animals  
14 that have been studied and reported, so it was -- it's  
15 impossible for us to provide specific toxicity data or  
16 locate data that hasn't been published or hasn't been  
17 reported. So there is a limitation in the exercise,  
18 and one can only report on information that is  
19 available.

20 And as has been identified earlier, one  
21 has to rely on surrogate animal studies to make  
22 estimates of sensitivities of wildlife because  
23 typically studies are not conducted on wildlife  
24 organisms, particularly sensitive species.

25 DR. EEDY: A. Yeah. I suspect it might

1 be against the Endangered Species Act--

2 MR. CRAIG: A. Yes.

3 DR. EEDY: A. --to conduct toxicity  
4 studies with endangered species.

5 MR. CRAIG: A. So just that simple  
6 mechanics. But what we were able to identify is that  
7 there was a reasonable factor of safety when we looked  
8 at the consumption levels required to produce  
9 responses, that with the broad enough species base we  
10 felt satisfied there would be no impending adverse  
11 effects.

12 Q. Dr. Eedy, is there any indication in  
13 the Weeks study that Weeks performed studies on  
14 endangered U.S. species?

15 DR. EEDY: A. I'm not familiar with the  
16 Weeks study.

17 Q. Sorry, Mr. Craig. Is there any  
18 indication that Weeks performed experiments on the  
19 woodpecker as opposed to simply performing other  
20 studies in relation to them?

21 MR. CRAIG: A. No, they're referring to  
22 laboratory surrogates here.

23 Q. Thank you. So that if I understand  
24 your testimony, Mr. Craig, you performed a literature  
25 search and you did not perform any actual studies; is

1           that correct, for your evidence here?

2                   A.   Yes.

3                   MR. CASTRILLI:  Thank you.  Madam Chair,  
4           this would be an appropriate place to break for the  
5           day.

6                   MADAM CHAIR:  Thank you, Mr. Castrilli.

7                   MR. HUFF:  Madam Chair?

8                   MADAM CHAIR:  Yes, Mr. Huff.

9                   MR. HUFF:  My undertaking on the bunch  
10          berries, do you want it dealt with?

11                  MADAM CHAIR:  Oh yes, please.  We have  
12          got to know what bunch berries are.

13                  MR. HUFF:  Cornus canadensis.

14                  MR. CASSIDY:  Just before -- he's not a  
15          witness.

16                  MADAM CHAIR:  Mr. Cassidy?

17                  MR. CASSIDY:  Before Mr. Huff purports to  
18          give evidence unsworn, I would like an undertaking from  
19          Forests for Tomorrow that there will be a witness  
20          available that can be cross-examined on this material,  
21          if we find it necessary, and I'm saying that without  
22          having had the opportunity to look at that material,  
23          but, you know, we do have a prescription against taking  
24          unsworn evidence except in the circumstances described  
25          at satellite hearings.

1 MADAM CHAIR: That's right.

2 MR. CASSIDY: And I would like that  
3 observed and respected.

4 MR. HUFF: Absolutely.

5 MR. CASSIDY: So I have the undertaking  
6 from Forests for Tomorrow that there will be a witness  
7 available to be cross-examined on this, including  
8 whatever oral evidence is about to be offered.

9 MADAM CHAIR: Well, Mr. Huff doesn't have  
10 to give us oral evidence, he has a handout I think to  
11 give us.

12 MR. CASSIDY: I think that would be  
13 appropriate.

14 MR. CASTRILLI: Madam Chair, could I have  
15 one moment's indulgence.

16 With respect to Mr. Cassidy's comments, I  
17 I haven't seen what Mr. Huff is about to put to you.  
18 Mr. Huff is clearly not giving evidence, and I think at  
19 the end of the day either there will be evidence with  
20 respect to what he's putting - this document, whatever  
21 it is - or else, if there is nobody who speaks to the  
22 document, then the Board knows, and my friends can  
23 certainly make submissions at that time, as to what  
24 weight should be given to the document.

25 There is obviously more than one way to

1 deal with the document.

2 MADAM CHAIR: We are not going to get  
3 silly about this, Mr. Cassidy. We want to know what a  
4 bunch berry is. We can look it up ourselves.

5 MR. CASSIDY: I'm sorry. Madam Chair, I  
6 assure you, I do not intend to be silly about evidence  
7 either, but perhaps the way we can resolve this is if I  
8 can have the opportunity to look at this overnight  
9 and--

10 MADAM CHAIR: Go ahead.

11 MR. CASSIDY: --and five minutes of  
12 observation may in fact deal with the matter. But I do  
13 want to make it clear, I do not intend to be silly  
14 about this. We've had very technical evidence today  
15 and I want to ensure that we keep things on the road  
16 here.

17 Thank you.

18 MADAM CHAIR: That's fine. This is in  
19 response to a request from the Board because we do not  
20 know what bunch berries are.

21 MR. CASTRILLI: Thank you, Madam Chair.  
22 We are resuming tomorrow morning at 8:30?

23 MADAM CHAIR: Yes, Mr. Castrilli.

24 MR. CASTRILLI: Okay. Thank you.

25 DR. EEDY: Madam Chair, as you suggested,

1           could we have a list of --

2                   MADAM CHAIR:   Oh yes.

3                   DR. EEDY:   I think he said you had the  
4           one undertaking which you were after was answered.  
5           Does that mean there aren't any undertakings left or --

6                   MR. CASTRILLI:   Actually, Dr. Eedy, I  
7           wish I could tell you.   I think one of the matters we  
8           were going to talk about will be dealt with -- or two  
9           of them actually, will be dealt with tomorrow in two  
10          documents that I have provided to Mr. Craig this  
11          afternoon and we'll be discussing them tomorrow.

12                   MADAM CHAIR:   And the last matter...?

13                   MR. CASTRILLI:   The very last matter.

14                   MADAM CHAIR:   The last undertaking, was  
15          that clear to you, Mr. Craig?

16                   MR. CRAIG:   I understand that that's been  
17          addressed.   I think it was a matter of comparing the  
18          application rates mentioned by Weeks compared to those  
19          proposed for Ontario, but I thought we had covered that  
20          off.

21                   MR. CASTRILLI:   Perhaps we can review our  
22          notes for the evening, I'll have to review my notes for  
23          the evening.

24                   The two main ones that I recall will be  
25          dealt with tomorrow through documents I've provided to

1 Mr. Craig this afternoon. The third one I think we  
2 left it that if Mr. Craig had that information readily  
3 available, which I assume was in his material that he's  
4 filed with the Board, then we'd be able to deal with  
5 that. If it becomes more complex and cumbersome than  
6 that, then we can deal with that tomorrow.

7 MADAM CHAIR: All right.

8 Mr. Craig might want to go through his  
9 list, because some things we called undertakings and  
10 other things were answers to questions. So I was a bit  
11 confused about it, and if you want to bring it to us  
12 tomorrow morning and you can check it against Mr.  
13 Castrilli's list.

14 MR. CASTRILLI: Thank you.

15 MR. HUFF: Madam Chair, we will be  
16 dealing with bunch berries in the morning then?

17 MADAM CHAIR: We will discuss bunch  
18 berries in the morning.

19 ---Whereupon the hearing adjourned at 5:08 p.m., to be  
20 reconvened on Tuesday, June 5th, 1990, commencing at  
8:30 a.m.

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